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A SYSTEMATIC STUDY OF THE GENUS KALMIA (ERICACEAE)

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A study of the cytology and genetics of the genus *Kalmia* was started in 1961 by Dr. Richard A. Jaynes of the Connecticut Agricultural Experiment Station. At that time little was known about the genetics of this group although a few of the species are important ornamental shrubs. Dr. Jaynes has now accumulated many living representatives of most of the species due to the efforts of numerous botanists and friends. As a result of his studies (Jaynes 1968a, 1968b, 1969, 1971b) information is now available concerning cross compatibility, speciation, and possible evolutionary relationships within the genus.

As treated here, the genus is composed of seven species, six varieties and numerous forms, both natural and cultivated. The genus is restricted to North America and Cuba, being particularly abundant along the east and west coasts and at higher elevations and latitudes. No monographic study of the genus has been undertaken, but the species have been adequately described in many floristic works, and Small (1914) treated all of the species that are presently recognized. Since one of the species is commonly cultivated and all are probably poisonous, this taxon has also been reviewed in horticultural and agricultural literature. This present study is an attempt to bring together most of this information in the light of what is now know about the genetics and cytology of the genus.

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HISTORY OF THE GENUS

References to mountain laurel, *Kalmia latifolia,* appear in the early literature of the American colonies. The Cape Cod "Rose-trees" of Henry Hudson's log (Purchas, 1625) may have been this species (Holmes, 1956), and Smith (1624) mentions that laurel occurs in Virginia. This species was first described and figured by Plukenet (1696) under the name *Cistus sempervirens,* described by Gronovius (1739) who called it "The Common Laurel/vulgarly called Ivy," while the first color print was figured by Catesby (1743) under the name *Chamaedaphne.*

Because of their potential as ornamentals, some of the species were introduced into Europe. According to Aiton (1789) *Kalmia latifolia* and *K. angustifolia* were introduced into England in 1734 and 1736 by Peter Collinson, an English merchant and fellow of the English and Swedish Royal Societies. A third species, *K. polifolia,* was introduced in 1767. Catesby (1743) reported that *K. latifolia* from Pennsylvania flowered in his garden at Fulham in 1740. Numerous horticultural forms have been developed as a result of breeding and selection in Europe for the past 200 years.

Probably the first detailed account of the toxic characteristics of the genus occur in Peter Kalm's journal (Benson, 1937) in which he described in detail the poisonous properties of the "Laurel Trees" (*Kalmia latifolia*). He also described both *K. angustifolia* and *K. latifolia* as to their characteristics, economic importance, habitat requirements and general distribution.

The generic name *Kalmia* was first proposed by Chenon (1751) in a doctoral thesis, and was based on specimens that Peter Kalm had collected during his trip to the New World. *Kalmia latifolia* and *K. angustifolia* are described in this thesis, and Linnaeus (1753) included both in his Species Plantarum. Later, Linnaeus (1754) described the genus and placed it in his first order (Monogynia) of his tenth class (Decandria).

The genus is now regarded as a relatively primitive member of the Ericaceae. Drude (1889) placed it in the Tribe Phyllodoceae Drude of the subfamily Rhododendroideae Drude, and its position has not been changed by most subsequent authors. The members of this tribe are generally evergreen plants, usually with buxoid or ericoid leaves, with regular flowers, and with seeds that usually lack appendages. Two microscopic characteristics of the anthers have also been used to characterize the tribe: the presence of resorption tissue involving the epidermis of the anther and the absence of filaments among the pollen tetrads. Copeland (1943) discussed in detail the morphology and anatomy of the tribe Phyllodoceae and considered the genera *Rhodothamnus* Reichenb., *Kalmia*, and *Phyllodoce* Salisb. to be relatively primitive, an opinion also expressed by Wood (1961). Studies of wood anatomy by Cox (1948) indicate that the genus *Kalmia* is closely related to

Rhodothamnus and that these two genera represent one of the three lines of evolution in the Phyllodoceae.

There have been few nomenclatorial complications in the genus, and only two other generic names have been proposed. Kuntze (1891) used Catesby's pre-Linnean name of *Chamaedaphne* and made wholesale transfers to it, while Small (1914) divided *Kalmia* into two genera. He proposed the genus *Kalmiella* for *Kalmia hirsuta* and its related species that differ by having a deciduous calyx and flowers borne singly in the axils of ordinary or somewhat reduced leaves. In all other morphological and anatomical characteristics these species do not differ from the other members of the genus, and there is no real justification for their removal. Except for Alain (1957), all subsequent authors have treated these species as members of the genus *Kalmia*.

ECONOMIC IMPORTANCE OF KALMIA

The genus *Kalmia* is economically important mainly because a few of the species are commonly grown as ornamentals. By far the most important species is the mountain laurel, *Kalmia latifolia*, which is commonly planted as an ornamental throughout its natural range as well as in other parts of North America and Europe where climate and soil are satisfactory. This species varies widely in flower color, foliage, and size, and many cultivars have been named and described (Holmes, 1956; Dudley, 1967). Cultivars of mountain laurel had been named by 1840, and at the present time at least 90 names have been applied to different forms of the species. This species has been suggested as a possible choice for the national flower of the United States (Van Rensselaer, 1889), and presently it is the state flower of Connecticut and Pennsylvania.

The sheep laurel, *Kalmia angustifolia*, is also becoming an important cultivated plant. Unlike the mountain laurel, this species can be propagated by cuttings. A number of cultivated forms are available, and selections should become available as soon as nurserymen become familiar with handling them. This species is not important for its wood as few specimens exceed 3 feet in height, but it is economically important as a weed. Smith, Hodgdon and Eggert (1947) considered it an important weed in low-bush blueberry fields and tried fire, continued cutting, and lime to control it. Later, Trevett (1956) reported on the effects of 2,4-D and 2,4,5-T in controlling sheep laurel in blueberry fields. Porcher (1869) found that the leaves and twigs of this species will dye cotton a fine drab color if a copper mordant is used.

The foliage of *Kalmia latifolia* is commonly gathered in eastern United States for floral displays as well as for Christmas decorations and other festivities, continuing a tradition started in colonial days. As early as 1913, Britton suggested that this species should probably be protected since it was becoming rare in some areas due to indiscriminate collecting. Buttrick (1924), in an extensive article concerning growth and cultivation of mountain laurel in Connecticut, estimated that the amount of foliage of this species used in New York City probably exceeded 1,000 tons per year and that the maximum amount used in the United States for decorative purposes probably exceeded 10,000 tons per year. It is still commonly found in decorations, but no figures are presently available concerning the amount used. The foliage of mountain laurel can also be used to dye cloth. Nicholson and Clovis (1967) found that the boiled leaves of this species produced a yellow tan color on wool if a chrome mordant was used.

In the past, the wood of the mountain laurel was occasionally used to make small items. Peter Kalm in his journal (Benson, 1937) mentions that the strong wood is carved into weaver's shuttles, pulleys, spoons and trowels. Browne (1857) considered the wood to be similar to that of the European Box and that it was sometimes used for the handles of light tools, for screws, boxes, and that it was supposed to make good clarinets. He also mentioned that the American Indians used the wood for making small dishes, spoons, and other domestic utensils, and according to Benson (1937), this was the source of the common name "spoonwood." Other uses include the making of rustic furniture and as a substitute for brier pipes (Britton, 1913). Due to the small size of most mountain laurel shrubs, the wood is rarely used at the present time except locally for tool handles and novelties.

Kalmia latifolia, as a common understory shrub, is important in preventing water runoff and soil erosion. Studies by Johnson and Kovner (1956) in the southern Appalachian Mountains show that the cutting of dense stands of laurel and rhododendron in hardwood stands decreased the evapotranspiration rate and correspondingly increased the annual streamflow on the average of 2 inches per year.

Extracts from the leaves of most species of *Kalmia* were at one time considered important as medicine. Barton (1802, 1804) mentions that a saturated tincture prepared from the leaves of *Kalmia latifolia* in a proof spirit could be used for certain fevers. According to Rafinesque (1830) preparations of this species were used as a narcotic, errhine, antisyphilitic and antiherpetic, while Griffith (1847) considered it useful for fever, itching and in cases of hemorrhaging and dysentery. Wood and Bache (1851) considered it useful mainly for cutaneous affections when applied as an ointment or decoction. During the latter part of the 19th century the leaves of *K. latifolia* were still commonly found in drug stores. According to Paschkis (1881), they were dried, rolled into a pipe-form and used principally as a remedy for diarrhea. The leaves of *K. hirsuta* were used in the south as a cure for itching and for mange in dogs (Porcher, 1869), while Holmes (1884) reports that *K. angustifolia* was commonly used by the Cree Indians of the Hudson Bay region for bowel complaints and as a tonic.

PROPAGATION OF KALMIA

Numerous cultivars of *Kalmia latifolia* have been named; no large scale nursery production of any of these forms exists, however, because they have been considered difficult to root, hard to graft, and are untrue from seed. As a result, one common source of this species for ornamental purposes has been native woodland stands. Recent studies, however, indicate that it is possible to root cuttings of this species and that selected types do breed true.

According to Jaynes (1971d) most *Kalmia* species can be started from cuttings. He found that greenwood cuttings of *Kalmia angustifolia, K. hirsuta, K. polifolia,* and *K. microphylla* root readily under mist or a plastic tent. By contrast, *K. cuneata* cuttings were difficult to root, while *K. latifolia* was highly variable in its rooting ability. In this latter species the ability to root is related to the age of the stock plant, since 89% of the cuttings from 1-year-old plants rooted, while only 21% of those from 4 or more year-old plants rooted. Jaynes also reported that most of the sterile hybrids can be propagated readily from cuttings, even when *K. latifolia* is one of the parents. Jaynes (1972) found that clones of *K. latifolia* vary in their ability to root from cuttings and that cuttings of cuttings or young grafts root more readily than cuttings from the original stock plant.

Few attempts have been made to graft any of the species of *Kalmia.* Trumpy (1893) had some success using side grafts with current year's wood of *Kalmia latifolia,* while Jaynes (1971d, 1972) grafted current year's growth of *K. latifolia* onto stock of the previous year using cleft or side-veneer grafts. The grafts were made in mid-June, kept in plastic tents for 6 weeks, hardened for 2 weeks, and overwintered in a lath house. The first report on the success of layering *K. angustifolia* was probably by Curtis (1795).

The propagation of *Kalmia* from seeds has been extensively studied. Nichols (1934) found that *Kalmia polifolia* seeds germinated only after stratification, while *K. angustifolia* and *K. latifolia* seeds had a germination rate 5 times higher after stratification for 12 weeks. In contrast, Jaynes (1971c) reported that of these 3 species, only *K. latifolia* required stratification, the others germinating without any pregermination treatment. Jaynes also found that *K. cuneata*, as well as *K. latifolia*, required stratification, but that soaking the seeds in gibberellin for 24 hours created the same response as stratification. The most difficult species to propagate appears to be *K. hirsuta*, which germinated best after a heat-humidity treatment (heating the seeds in a moist chamber at 80°C for 30-60 minutes). Jaynes (1968c) suggested that this response to high temperature may have adaptive value and could have evolved as a result of recurring ground fires. He also suggests that *K. ericoides*, a closely related species that is native to sandy pine areas of Cuba, may require a similar pregermination treatment. *Kalmia microphylla* is similar to *K. polifolia* in that it needs no pregermination treatment. The studies of Flemer (1949) and Jaynes (1971c) indicate that all species of *Kalmia* germinate best at 22°C under light in a mixture of sand, ground sphagnum, and peat moss that has a pH of 4.2.

A mycorrhizal association, without which growth will not occur, has been demonstrated for *Kalmia latifolia*, and it is probably necessary for all species of the genus. Flemer (1949) found that mountain laurel seedlings grew very poorly in sterile culture without the associated endophyte, but when the seedlings were combined with the fungal associate they rapidly outgrew the controls. Microscopic examination revealed hyphae sheathing the younger portions of the roots and frequent hyphal connections with mycorrhizal coils in the cortical cells. No attempt was made to identify the fungus involved.

GENETICS OF THE GENUS KALMIA

Many species of *Kalmia* are sympatric, and most have similar habitat requirements. Even so, no natural hybrids have been reported, and recent studies suggest that such hybrids are unlikely to occur. Jaynes (1968a, 1971d) made all possible crosses, including reciprocals, between 6 species of the genus (omitting only *Kalmia ericoides*) and found that the barriers to gene flow are well developed. Most of the interspecific crosses were difficult to complete since no seed was set, the resulting seed failed to germinate, or the seed produced albino or yellow-green seedlings. Stylar inhibition of pollen tube growth appeared to be the most common reason for the lack of seed set. Only 9 combinations yielded viable seedlings and all were sterile. By contrast, intra-specific crosses between plants differing in flower color and growth habit within and between geographic sources showed no evidence of genetic barriers.

Little is known about the inheritance of traits in the genus; the only detailed study involves flower color in *Kalmia angustifolia.* In this species, Jaynes (1971b) found that the presence of anthocyanin pigment is determined by a single dominant gene, with the homozygous recessive lacking red pigment in the leaves and stem and having white flowers. This trait is carried in the population as a heterozygote, but is rarely expressed. These white forms are at a selective disadvantage in the wild as the seedlings are weak, especially when small.

Inbreeding depression and self incompatibility have been observed in some species of *Kalmia.* Jaynes (1968b) found that self pollinated *Kalmia latifolia* and *K. angustifolia* set 85-90% less seed than cross pollinated plants, while *K. polifolia,* in contrast, showed no self incompatibility. The seedlings of all three species, however, showed inbreeding depression. As measured by height growth, the vigor of the outcrossed seedlings was generally twice that of the selfs. Jaynes (1971a) also noticed inbreeding depression when sibling red-budded mountain laurel was crossed. It is possible that compact seedlings of *Kalmia* species of potential ornamental value can be obtained by selfing.

Few cytological studies of the genus have been undertaken. Hagerup (1928) in an extensive cytological study of the bicornes reported a chromosome number of $n = 12$ for *Kalmia latifolia* and $n = 24$ for *K. glauca* (*K. polifolia*). He found that the chromosomes of *K. polifolia* were about half as large as those of *K. latifolia,* so that the amount of chromatin in the two species seemed to be about the same. Later, Callan (1941) reported a chromosome number of $2n = 44$ for *K. polifolia,* which in light of recent studies is an error. Jaynes (1969) studied cytologically all of the taxa except for the Cuban species. He found that with the exception of *K. polifolia* ($n = 24$), all had a chromosome number of $n = 12$. No differences were found in the size of the chromosomes, and their smallness prevented a karyotype analysis.

POLLINATION IN KALMIA

The most distinctive feature of the genus is its pollen-discharge mechanism. Near the middle of the corolla are 10 sacs that form small lobes on each keel of the flower bud. Just before anthesis the anthers are pushed upward into these sacs by the elongating filaments. As the corolla opens the anthers are held in the sacs and are carried down and outward, the elastic filaments being bent backward under tension. When the flower is disturbed by a large insect, one or more of the anthers are released from their sacs. The filament, which is under tension, snaps the anther upward, showering the insect with pollen. This mechanism was first described by Sprengel (1793) and later by Hasskarl (1863) for *Kalmia latifolia,* while Rothrock (1867) observed the same mechanism in *K. angustifolia.* Studies by Penhallow (1882) showed that the pollen of *K. latifolia* could be thrown up to 14 cm. from the flower while in *K. angustifolia* it was thrown up to 8 cm. away. These authors suggested that this was a method of insuring self-pollination since the pollen was thrown toward the stigma of the flower. Beal (1867) was the first to describe the way in which the flowers were cross-pollinated by insects. He observed that while a bumble bee was searching around the base of the flower, the proboscis liberated the stamens which projected their pollen onto the underside of the insect's body. This pollen was then rubbed onto the stigma of other flowers visited. This process was also discussed by Gray (1876, 1879).

When an anther is released, the pollen tetrads are discharged as a fine powder in some species, and in others as a sticky net caused by the presence of viscid threads that hold the tetrads together. According to Matthews and Knox (1926) these extremely fine, non-cellular threads are probably derived from small quantities of microspore mother cell protoplasm which are excluded from the pollen tetrads. They also suggest that this feature is an adaptation that facilitates pollination in relatively large, upright flowers like those of the genus *Rhododendron.* These threads were found in *Kalmia latifolia* by Ikuse (1954) and have been observed by the present author in *K. hirsuta* and *K. ericoides.* Their presence or absence was used by Copeland (1943) as a major characteristic in separating the tribes of the subfamily Rhododendroideae, with the tribe Phyllodoceae being the only one that consistently lacked these threads. According to Wood (1961) it is now apparent that viscid threads do occur in some species of *Kalmia, Phyllodoce* and *Loiseleuria,* all members of the Phyllodoceae. Because of this, the usefulness of this characteristic to distinguish tribes is doubtful.

Only a few species of insects have been observed pollinating *Kalmia* species. Beal (1867) listed bumble bees and other Hymenoptera, but mentions no species. The only detailed account was by Lovell and Lovell (1934) who collected and identified the pollinators found on a population of *Kalmia angustifolia* near Waldoboro, Maine. Their observations show that *K. angustifolia* is effectively cross-pollinated by bees and that a total of 14 species of insects is capable of springing the stamens. Of these, *Bombus ternarius* and *Andrena vicina* were the most common visitors to the flowers. During the present study, populations of *K. angustifolia* and *K. latifolia* were examined in southern Connecticut, and all insects found to release the stamens were collected and identified. These studies were made for 2 hour periods, at various times each day, from June 15 to June 25, 1970. In most instances the insect did not release the stamen by just landing on the flower. Usually the stamens were sprung by the proboscis while searching for nectar, but sometimes the legs set the stamens free. No honey bees were found on the flowers, and none were reported by Lovell and Lovell (1934).

Recently bees have been used by Jaynes (1971a) to pollinate caged plants of *Kalmia latifolia* and *K. angustifolia* for the large scale production of seed. In these experiments selected plants were caged before the flower buds opened. Honey bees (*Apis* spp.) or bumble bees (*Bumbus* spp.) were introduced into the cages when the flowers started to open. The plants that were in cages with bumble bees set large quantities of seeds (58 to 95% of the flowers forming capsules), while plants in cages with honey bees set fewer seeds (2 to 31% of the flowers forming capsules). Plants that were in cages with no bees rarely set seed (less than 1% of the flowers forming capsules).

CHEMISTRY OF KALMIA

Catesby (1743) was one of the first to report on the poisonous properties of members of this taxon. He found that when cattle and sheep were deprived of better food during severe winters, many died from eating the leaves of *Kalmia latifolia* (as *Chamaedaphne*). An extensive report by Kalm (Benson, 1937) mentions that young sheep die immediately or become very sick after eating leaves of *Kalmia latifolia,* but calves "were cured by giving them gunpowder and other medicines." According to Kalm, larger domestic animals are also affected by the leaves.

Most of the literature on livestock poisoning by *Kalmia latifolia* and *K. angustifolia* has been reviewed by Crawford (1908), Muenscher (1957) and Kingsbury (1964). Some experimental work has been done to determine the symptoms, dosage, and treatment of the poisoning by these species. One of the first studies was made by Wood (1883), who fed a decoction of *K. angustifolia* leaves to a sheep. The symptoms were similar to those observed by Pritchard (1956) who studied *K. angustifolia* poisoning in a flock of

Minnesota sheep. Experiments with *K. latifolia* by Cary and Matthews (1903), Crawford (1908) and Marsh and Clawson (1930) showed that all livestock tested were poisoned by this species. The western species, *K. microphylla,* is also poisonous but, because of its habitat, is seldom encountered by livestock. Fleming (1920) fed this species to some calves and sheep, most of which became sick, while Clawson (1933) found that the symptoms exhibited by sheep and goats were similar to those observed in animals fed *K. latifolia* and *K. angustifolia.* No information is available concerning the poisonous properties of the other members of the genus.

Catesby (1743), Kalm (Benson, 1937), Bigelow (1818), and other early authors mentioned that deer can eat the leaves of mountain laurel without suffering ill effects. Forbes and Bechdel (1930, 1931) indicate that laurel is eaten in considerable quantity by deer, especially in time of food shortage. When restricted to a laurel diet, however, deer become thin and weak and usually develop a mild condition of rickets. Death results when the animals are fed in excess of 1.29% of their live weight of laurel leaves.

All species of *Kalmia* are probably poisonous to humans (Hardin and Arena, 1969), although no deaths have been attributed directly to this genus. Bigelow (1818) and Griffith (1847) have reported instances of poisoning in humans. In these cases, a decoction made from the leaves of *Kalmia latifolia* produced toxic symptoms. The tough leaves and their bitter taste make it unlikely that anyone would eat them. Also, the quantity required to produce illness is greater than what a person would probably consume. According to Barton (1802) the Delaware Indians used the leaves of *K. latifolia* for suicide.

It has been suggested by various authors that the honey produced from *Kalmia* flowers is poisonous, but no definite proof is available. Barton (1802) reported that the honey from *Kalmia angustifolia, K. latifolia,* and *K. hirsuta* is poisonous to humans and listed a few instances of suspected poisoning by honey of these species. Miller (1895) and

Pellett (1920), in contrast, doubted that mountain laurel was responsible for poisonous honey. They felt that due to the abundance of this species it would seem that the cases of poisoning would be reported much more frequently if there was good reason to suspect the honey from this source. Some doubt is also expressed by Lovell (1926, 1951) since bees are rarely found on mountain laurel. Howes (1949), as well as Hardin and Arena (1969), indicate that *Kalmia latifolia* honey is an extremely distressing narcotic, varying in its effect in proportion to the quantity eaten. In none of the reports is the source of the poisonous honey known for certain, the genus *Kalmia* being suspected because other parts of these plants are known to be poisonous.

Andromedotoxin, the poisonous compound found in the genus *Kalmia*, is known to occur also in other genera of the Ericaceae. Numerous attempts have been made to isolate and determine the chemical structure of this compound. Lasché (1889) reported the occurrence of andromedotoxin in the leaves and twigs of *Kalmia angustifolia* and also in the fruits of *K. latifolia*, while Matusow (1897) found what he considered andromedotoxin in the roots of *K. latifolia*. More recently Jacobs and Lloyd (1939) and Waud (1940) isolated andromedotoxin from *K. angustifolia*. The chemical structure of andromedotoxin has been studied by Wood, Stromberg, Keresztesy and Horning (1954) and more recently by Tallent, Riethof and Horning (1957). The latter authors renamed the substance acetylandromedol and developed a procedure for detecting its presence in plant extracts through the use of paper electrophoresis. Though the chemical structure of andromedotoxin is still in doubt, its empirical formula is probably $C_{22}H_{36}O_7$.

FOSSILS OF KALMIA

Only a few fossil species of *Kalmia* have been named. Most are described from leaf impressions, and except for size, shape, and probable coriaceous texture, there is little reason to consider them members of the genus *Kalmia*, or members of the family Ericaceae. One living species is also known from fossil remains.

Kalmia brittoniana Hollick (1892).

This fossil was first described from clay beds of the Raritan formation, near Kerischerville, Staten Island, New York and is Upper Cretaceous in age (Museum, Staten Island Association of Arts and Science). The material illustrated consists of parts of three oblong, entire, probably coriaceous leaves, 0.7 × 2.7 cm., with prominent midribs and no secondary veins. Hollick (1906) mentions that the absence of secondary nervation, indicating a leaf of thick, coriaceous texture, was what largely influenced his referring the leaf to the genus *Kalmia*. This species has also been reported from the Upper Cretaceous deposits of North Carolina (Berry, 1907, 1920) and Alabama (Berry, 1913, 1919). When he described *Kalmia brittoniana* from the Tuscaloosa formation of Alabama, Berry (1919) suggested that there is no reason for its placement in the genus *Kalmia*, or even in the Ericaceae. He further sugested that the fossil probably represents some Upper Cretaceous species of the Proteaceae or the Myrtaceae.

Kalmia ? elongata Ashlee (1932).

This species was found in the Latah formation, Elk River, Idaho, and is Upper Miocene in age (University of Idaho collection No. 303). The specimen consists of two narrowly elliptical, subcoriaceous leaves, 0.9 × 1.7 cm., with entire margins and a petiole 2-4 mm. long. The leaves are superficially similar to *Kalmia microphylla*, but since the midrib is grooved and the secondary and tertiary veins are present, this fossil must be considered a doubtful member of the genus.

Kalmia elliptica Brown (1962).

This species was found in the Fort Union formation (Ilo Post Office, Wyoming) and the Denver formation (Golden, Colorado) and is Paleocene in age. The specimen illustrated by Brown (1962) consists of a single elliptic leaf with entire margins and secondary and tertiary veins that irregularly fork and loop near the margins. The specimen is similar in outline to a typical leaf of *Kalmia latifolia* but is about twice as large (7 × 17 cm.). The presence of the well developed and large number of secondary and tertiary veins, as well as their angle to the midrib, is not typical of any present day species of *Kalmia*. It must therefore be considered a doubtful member of the genus.

Kalmia saxonica Litke (1968).

This species was found at Brandis, northwest Saxony, Germany, and is Lower Miocene in age. It consists of pieces of cuticle with the upper epidermis occasionally attached. These fragments indicate that the leaf was entire margined, 1-1.3 cm. wide, and had an obvious midvein. The cells are polygonal with wavy margins, the stomata are round, 18μ wide, surrounded by a double cuticular ring and occasionally by radiating cuticular striations. The basal portion of glandular hairs are also present. The structure and arrangement of the cells is similar to that found in *Kalmia latifolia*, and it is possible that this fossil represents a member of this genus or a closely related genus of the Ericaceae. Similar cuticle remains were placed in the form genus *Kalmiophyllum* by Kräusel and Weyland (1959) when they described the species *Kalmiophyllum marcodurense*.

Kalmia polifolia, the Bog Laurel, has also been found in fossil form. It was first reported by Berry and Johnston (1922, as *K. glauca* Ait.) from interglacial deposits at Point Grey near Vancouver, British Columbia. The fossil specimen illustrated is of the same shape and size as those of living specimens of *K. polifolia*. Since the other fossil plants found clearly indicate a bog habitat, it is very possible that this fossil is a species of *Kalmia*. *Kalmia polifolia* has also been reported from Pleistocene lake deposits of the upper Connecticut River Valley in northern New Hampshire (Hollick, 1931). These fossils are post-glacial in age and according to Hollick are representative of the flora that migrated northward in the wake of the retreating Wisconsin ice sheet. The other fossil species found in the same deposits indicate a habitat and climate similar to that presently prevailing in the area. The plates in this article show excellent examples of leaves very similar in shape and size to those of living *K. polifolia.* As mentioned by Hollick, however, positive identification would "merely represent a matter of personal opinion" since the leaves of *K. polifolia, Andromeda polifolia,* and *Ledum groenlandicum* appear almost identical in outline.

TAXONOMIC TREATMENT

KALMIA Linnaeus, Sp. Pl. 1: 391. 1753.
Kalmiella Small, Fl. Southeast. U. S. 886. 1903.
Chamaedaphne Catesby ex Kuntze, Rev. Gen. Pl. 2: 388. 1891, non Moench.

Evergreen or rarely deciduous shrubs or small trees with pubescent to occasionally glabrous, terete or 2-edged twigs. Lateral buds very small, flattened, with 2 exposed valvate to overlapping scales. Leaves alternate, opposite, or in whorls of 3, exstipulate, usually coriaceous, petioled to subsessile, margins entire. Flowers solitary in the axils of leaves, or in terminal or axillary corymbiform racemes, or in terminal compound corymbs. Pedicels slender, terete, usually pubescent and with stalked glandular hairs, subtended by a pair of bractlets in the axil of a small leaf-like bract. Flowers 5-merous, actinomorphic, with hypogynous insertion. Calyx synsepalous, usually green and persistent in fruit; lobes 5, longer than the tube. Corolla sympetalous, white to pink, red or purple, with a short cylindrical tube extending into a rotate limb that is shallowly 5-lobed and commonly 10-keeled, the limb with 10 saccate depressions in which the anthers are held under tension. Stamens 10, shorter than the corolla; filaments usually filiform, glabrous or pubescent, dorsifixed; anthers 2-celled, unappendaged, short, ovoid, opening by large terminal slits; pollen discharged in tetrads, with or without viscid strands. Ovary superior, 5-celled, placentation axile, placentae massive with numerous ovules; style slender, terete, nearly straight; stigma unexpanded, slightly grooved. Fruit a subglobose to globose, 5-valved, septicidal capsule usually subtended by the persistent calyx. Seeds numerous, small and lightweight, testa tight or loose and extending well past the ends of the remainder of the seed. A North American genus extending from Alaska south in the mountains to California and Utah, eastward through Canada to the Atlantic Ocean and southward through eastern United States to Florida and Cuba.

Lectotype Species: *Kalmia latifolia* L. (cf. Britton 1908).

KEY TO THE SPECIES OF KALMIA

A. Leaves opposite; inflorescence a terminal corymbiform raceme.
  B. Midrib of leaves lacking stalked glands; seeds less than 1.5 mm long . . . . 1. *K. microphylla.*
  B. Midrib of leaves with stalked glands on both surfaces; seeds more than 1.5 mm long. . 2. *K. polifolia.*
A. Leaves alternate or in whorls; inflorescence various.
  C. Inflorescence a terminal compound corymb; leaves usually more than 2 cm broad. . . . . . 3. *K. latifolia.*
  C. Inflorescence a simple corymbiform raceme or the flowers solitary in the axils of the leaves; leaves usually less than 2 cm broad.
    D. Leaves more than 1.5 cm long; inflorescence a corymbiform raceme from the axils of the leaves.
      E. Leaves in whorls of 3, evergreen. . . . . 4. *K. angustifolia.*
      E. Leaves alternate, deciduous. . . 5. *K. cuneata.*
    D. Leaves less than 1.5 cm long; flowers mostly solitary in the axils of the leaves.
      F. Leaves broad, flat, the margins only slightly revolute; flowers scattered along the stem in the leaf axils. . . . . 6. *K. hirsuta.*
      F. Leaves narrow, strongly revolute; flowers clustered toward the ends of the twig giving the appearance of a terminal corymbiform raceme. . . . . 7. *K. ericoides.*

1. **Kalmia microphylla** (Hooker) Heller, Bull. Torrey Bot. Club **25:** 581. 1898.

Low growing alpine plant to sparingly branched shrub to 6 dm tall; branchlets terete to slightly 2-edged below the leaves, glabrous to lightly pubescent; leaves opposite, subsessile, the broad petiole to 2 mm long, the blades coriaceous, ovate to oval to narrowly lanceolate, to 4 cm long, 0.4-1.1 cm broad, whitened beneath with small hairs, a band of white hairs usually present on the upper surface on either side of the midrib, midrib lacking stipitate glands, margins flat to slightly revolute; inflorescence a few-flowered, terminal, racemose cluster, each flower on a glabrous pedicel 1-3 cm long, each pedicel subtended by a pair of bractlets in the axis of a leaf-like bract; calyx pink to light green, 5-10 mm broad, the lobes obtuse, margins ciliate; corolla rose-purple (rarely white), 0.8-2.0 cm broad; anthers purple, 0.6-1.6 mm long; fruit subglobose, 4-7 mm broad, 3.5-6 mm long; seeds 0.8-1.4 mm long, the testa extending past the ends of the seed. Chromosome number $n = 12$.

Kalmia microphylla has rarely been considered specifically distinct from *K. polifolia*. Hall (1912), when he transferred the taxon to a variety of *K. polifolia* mentioned that "No characters upon which the variety might be raised to specific rank have as yet been pointed out, except the variable one of size in plant and leaf." Most present floristic works maintain this taxon as a variety or subspecies of *K. polifolia,* though it has been considered a separate species by Small (1914), Rydberg (1954), Hultén (1948) and Abrams (1951). Hultén (1948) mentioned that it was with some hesitation that he accepted *K. microphylla* as being specifically different from *K. polifolia,* but that in Alaska, there does not seem to be any intermediate types. However, in 1968 he considered *K. microphylla* a subspecies of *K. polifolia.*

When these taxa are considered distinct the characters of plant and leaf size are the most commonly used for separation. *Kalmia polifolia* is a large shrub, 3 or more dm tall, the leaves are 2-4 cm long, 2½ to 3 times longer than broad, and the margins are usually strongly revolute. *Kalmia microphylla,* in contrast, is a much smaller plant, usually less than 1.5 dm tall, the leaves are usually less than 1.5 cm long, less than 2½ times as long as broad, and the margins are little if at all revolute. In most instances, these characters are sufficient to separate the two taxa; however, variation and overlapping of characters do occur. Other characters that have previously been overlooked are much more reliable in separating the two species. In *K. polifolia* clavate glands are present on the upper and lower surface of the leaf midrib, and the seeds are 1.5 to 2.2 mm long, while in *K. microphylla* these glands are absent, and the seeds are usually less than 1.3 mm long.

Kalmia microphylla is the only species of the genus found west of the Rocky Mountains. It extends from central California north to Alaska, and east through the Yukon and Northwest Territories to the extreme northwest corner of Manitoba. It is primarily a low-growing alpine shrub rarely exceeding 1 dm in height, but in bogs at lower elevations it may reach a height of 6 dm. The species consists of two varieties, one restricted to alpine and tundra areas, and one found in coastal lowland regions.

KEY TO VARIETIES

1. Leaves oval to broadly elliptic, usually less than 2 cm long and less than 2½ times as long as broad; calyx less than 7 mm broad. . . . . 1a. var. *microphylla.*
1. Leaves lanceolate, usually 2.5 cm long or longer, 2½ to 4 times as long as broad; calyx over 7 mm broad. . . . . 1b. var. *occidentalis.*

1a. **Kalmia microphylla** (Hooker) Heller var. **microphylla.** *Kalmia glauca* Ait. γ *microphylla* Hook. Fl. Bor.-Amer. 2: 41. 1834. TYPE: swamps in the Rocky Mountains, *Drummond* (K). *Kalmia polifolia* var. *microphylla* Rehder in Bailey, Cycl. Am. Hort. 2: 854. 1900. (without basionym). *Kalmia polifolia* var. *microphylla* (Hooker) Hall, Univ.

California Publ. Bot. 4: 201. 1912. *Kalmia polifolia* ssp. *microphylla* (Hooker) Calder & Taylor, Canad. Jour. Bot. **43**: 1398. 1965.

Sparingly branched alpine shrub usually less than 1 dm tall (to 3 dm tall at lower elevations); nodes usually less than 1 cm apart; leaves ovate to oval to broadly elliptic, to 1.5 (rarely 2.5) cm long, less than 2½ times as long as broad; calyx pink to light green, 5-7 mm broad; corolla rose-purple 0.8-1.2 (rarely 1.5) cm broad; fruit 4-5 mm broad, 3.5-4.5 mm long; seeds 0.8-1.3 mm long.

Distribution: Mountainous regions of western North America from California, Nevada, Utah and Colorado north through the Rocky Mountains to the Yukon and Northwest Territories.

Common name: Alpine Laurel, Small-leaved Kalmia.

REPRESENTATIVE SPECIMENS

UNITED STATES: **Alaska:** Skagway, *Anderson* 1608 (ISC), *Eastwood* (GH). **California:** EL DORADO CO.: Echo Lake, *Beatle & Beatle* 3959 (ARIZ, DUKE, NY). FRESNO CO.: Marie Lake, *Kruckeberg* 3487 (RM, WS). HUMBOLDT CO.: Trinity Summit, *Davy & Blasdale* 5823 (US). INYO CO.: Pine Creek, *Duran* 3338 (GH, MICH, US). MADERA CO.: Shadow Creek, *Raven* (NY). MARIPOSA CO.: Crescent Lake, *Congdon* (MIN, WS). MODOC CO.: Dismal Swamp, *Weatherby* 1598 (NY, RM). MONO CO.: Treble Lake, *Munz* 19998 (NY). NEVADA CO.: Frog Lake, *Sonne* 438 (MU, PH, US). PLACER CO.: Squaw Valley, *Eggleston* 21607 (GH, NY, US, WS). PLUMAS CO.: Long Lake, *Hall* 9325 (GH, RM, US). SHASTA CO.: Lassen Nat'l Park, *Ferris & Lorraine* 10459 (GH, RM, US). SISKIYOU CO.: Mt. Shasta, *Cooke* 11296 (GH, OSC), 17654 (WS, WIU). TULARE CO.: Sky Blue Lake, *Howell* 25555 (US). TUOLUMNE CO.: Unicorn Creek, *Mason* 698 (GH). **Colorado:** BOULDER CO.: Brainard Lake, *Green* 279 (PENN). CLEAR CREEK CO.: Loveland Pass, *Robbins* 732 (ARIZ). GILPIN CO.: Forest Lake, *Roberts* (CM). JACKSON CO.: Cameron Pass, *Beaman & Erbisch* 1362 (MSC, RM). JEFFERSON CO.: Geneva Creek, *Livingston* 298 (DUKE). LARIMER CO.: Estes Park, *Cooper* 116 (RM), 157 (ARIZ, MIN, NMC, RM). ROUTT CO.: Routt Nat'l. Forest, *Weber* 6991 (WS). **Idaho:** BLAINE CO.: Sawtooth Peaks, *Macbride & Payson* 3707 (GH, RM, US). BOISE CO.: Middle Spangle Lake, *Hitchcock & Muhlick* 10130 (GH, NY, RM). BONNER CO.: Priest Lake, *MacDougal* 292 (NY). BOUNDARY CO.: Mt. Roothaan, *Daubenmire* 44289 (WTU). CLEARWATER CO.: Lolo Trail Rd., *Joslyn* 953 (ID), 954 (ID). FREMONT CO.: Henry Lake, *Payson & Payson* 2047 (GH, NY, RM). IDAHO CO.: Big Fog Mt., *Baker* 14762 (ID). SHOSHONE CO.: Little Lost Lake, *Wilson* 313 (GH, IDS, WS). VALLEY CO.: Boulder Lake, *Boone* 177 (ID). **Montana:** BEAVERHEAD CO.: Odell Lake, *Hitchcock & Muhlick* 14915 (NY, WS, WTU). CARBON CO.: Beartooth Mts., *Cronquist* 8068 (GH, NY, WS, WTU). DEER LODGE CO.: *Wate* (MONT). FLATHEAD CO.: Johns Lake, *Standley* 18513 (US). GALLATIN CO.: Spanish Peaks, *Vogel* (GH, MONT, US). GLACIER CO.: Hidden Lake, *Hitchcock* 1905 (MONT, RM). GRANITE CO.: Helena, *Kelsey* (MU, NY). LAKE CO.: McDonald Lake, *Hitchcock* 18343 (RM, WS, WTU). MADISON CO.: Old Hollowtop, *Rydberg & Bessy* 4654 (MONT). MISSOULA CO.: Lace Lake, *Rossbach & Rossbach* 184 (WTU). PARK CO.: Lady of the Lake, *Witt* 1233 (MINN, NY, WS, WTU). POWELL CO.: Upper Tincup Creek, *Trask* 117 (MONT). RAVALLI CO.: St. Mary's Peak, *Hitchcock & Muhlick* 15332 (NY, WS, WTU). STILLWATER CO.: Stillwater, *Hawkins* 35502 (MONT). SWEET GRASS CO.: Rainbow Lake, *Hitchcock* 16501 (CAN, IDS, NY, WS, WTU). TETON CO.: Henry Mts., *Williams* (GH). **Nevada:** ELKO CO.: Lamoille Lake, *Holmgren* 1404 (BRY, NY). WASHOE CO.: Mt. Rose, *Archer* 6425 (ARIZ, GH, NY, RENO). **Oregon:** BENTON CO.: Three Sisters, *Vechten* 212 (OSC). CLACKAMAS CO.: Clackamas Lake, *Bartlett & Grayson* 791 (NY). CROOK CO.: Des Chutes Nat'l. Forest, *Ferris & Duthie* 488 (RM). DESCHUTES CO.: Sparks Lake, *Bellinger* (WILLU). DOUGLAS CO.: Umpqua, *Ingram* 1515 (ORE). JACKSON CO.: Mt. Pitt, *Peck* 5184 (WILLU). KLAMATH CO.: Crater Lake *Applegate* 319 (US, WILLU), 345 (US). LANE CO.: McKenzie Pass, *Henderson* 16315 (ORE). LINN CO.: Hensley Meadows, *Coville & Applegate* 1152 (US). MARION CO.: Russell Lake, *Lee* 44 (OSC). UNION CO.: *Head* 1298 (OSC). WALLOWA CO.: Mirror Lake, *Peck* 1777 (NY, WILLU). **Utah:** DUCHESNE CO.: Mt. Agassiz, *Cottam & Biddulph* 3703 (BRY). SUMIT CO.: Motte Peak, *Payson & Payson* 5139 (CHRB, GH, PH, RM, US, WS). UINTAH CO.: Leidy Peak, *Maguire* 17679 (RM). UTAH CO.: Grandaddy Lakes Basin, *Stutz* 224 (BRY). **Washington:** CHELAN CO.: Ice Lake, *Morrill* 332 (MONT, ND, WTU). KITTITAS CO.: Mt. Stuart, *Elmer* 1103 (GH, K, MIN, US, WS). KLICKITAT CO.: Falcon Valley, *Suksdorf* (PH, WS, WTU). LEWIS CO.: Reflection Lake, *Townsend* (WS). OKANOGAN CO.: Slate Peak, *Ownbey & Meyer* 2302 (GH, IDS, ISC, MIN, NY, OSC, US). PEND OREILLE CO.: Sullivan Lake Dist., *Layser* 866 (WS). PIERCE CO.: Mt. Rainier, *Allen* 96 (CAN, GH, K, MIN, MSC, NY, US, WS). SKAMANIA CO.: Chiquash Mts., *Suksdorf* (WS). WHATCOM CO.: Mt. Baker, *Muenscher* 8077 (WS). YAKIMA CO.: Bird Creek Meadows, *Zuberbuhler* (WS). **Wyoming:** ALBANY CO.: Brooklyn Lake, *Nelson* 9226 (GH, MIN, RM). BIG HORN CO.: Upper Crater Lake, *Lofgren* 13 (MIN, NY, RM). CARBON CO.: Silver Lake, *Henry* (CM). FREMONT CO.: Gannett Creek, *Jozwik* 386 (GH, RM). JOHNSON CO.: Powder R. Pass, *Stephens* 40827 (VDB). LARIMER

CO.: North Park Range, *Goodding* 1839 (PENN). PARK CO.: Island Lake, *Truman* 54298 (WTU). SHERIDAN CO.: Dome Lake, *Pammel & Stanton* 62 (MIN). TETON CO.: Taggart Lake, *Williams* 1119 (ID, MIN, OSC, RM). YELLOWSTONE NAT'L. PARK: Artists Paint Pots, *Nelson & Nelson* 6170 (CM, ISC, MIN, GH, NY, RM, US).

CANADA: **Alberta:** Banff Nat'l. Park: Bow Pass, *Saunders* 11 (TRT); Lake Louise, *Brown* 578 (GH, PH, US), *McCalla* 2162 (ALTA, NY, US); Waterfowl Lake, *Walker* 2443 (PENN). Jasper Nat'l. Park: Athabasca Falls, *Moss* 2752C (ALTA, GH); Maligne Lake, *Scamman* 2664 (GH); Amethyst Lake, *MacFadden* 3246 (NO). Waterton Lakes Nat'l. Park: Summit Lake, *Moss* 975 (GH, NY, US); Upper Twin Lake, *Blais & Nagy* 1793 (CAN). Fairfax Lake, *Damais & Anderson* 2335 (ALTA); Mercoal, *Woollven* 6 (ALTA); Viewpoint, *Damais & Kempinsky* 5683 (ALTA); Virginia Hills, *Moss* 12469 (ALTA), 12503 (ALTA, CAN). **British Columbia:** Ernest C. Manning Prov. Park: Timberline Valley, *Hardy* 18501 (UBC, V); Three Brother Mts., *Underhill* 782 (V). Garibaldi Prov. Park: Castle Towers, *Davidson* (UBC). Glacier Nat'l. Park: Bald Mt., *Fogg, Jr.* 1273 (PENN, UBC); Eagle Mt., *Rosendahl* 944 (MIN). Kokanee Glacier Prov. Park: *Thompson* 14447 (CAN, GH, MICH, NY, PH, US, WTU). Kootenay Nat'l. Park: Ross Lake, *McCalla* 9603 (UBC, V); Emerald Lake, *Brown* (TRT). Mt. Assiniboine Prov. Park: Magog Lake, *Green* 551 (PENN). Mt. Revelstroke Nat'l. Park: *Calder & Savile* 10861 (NY, US), 8884 (NY, US). Tweedsmuir Prov. Park: *Trew* 17177 (V). Wells Gray Prov. Park: Battle Mt., *Ahti & Ahti* 6975 (V, WTU). Yoho Nat'l. Park: Emerald Lake, *Beer* (CM); Selkirk, *Shaw* 41 (GH, MIN, NY, PENN, US); Yoho Lake, *Pease* 22371 (MASS). Vancouver Island: Mt. Arrowsmith, *Taylor* 164 (TRT); Mt. Albert Edward, *Hett* 352 (V); Moat Lake, *Underhill* 299 (WTU). Atlin, *Szczawinski* (UBC, V). Caribou Pass, *Henry* 608 (GH, ISC); Ft. Steele, *Johnstone* (UBC, V); Lillooet, *Beamish & Vrugtman* 610710 (UBC); Mt. Hazel, *Slocomb* (V); Penticton, *Calder & Savile* 10751 (NY, RM, UBC, V, WS); Prince George, *Holland* (V); Sikanni Chief R., *Henry* 743 (PH); Summit Lake Landing, *Weber* 2589 (GH, WS); Skagit Valley, *Macoun* 72406 (ND, NY); Tenquille Lake, *Beamish & Vrugtman* 61010 (ID, UBC, WTU). **Manitoba:** Churchill, *Beckett* M-45-5 (MIN), *Ellis* 1287 (US), *Gillett* 1832 (ISC, US), *Gillis* 3244 (MSC), *Voss* 8999 (MICH), *Walker* 5090 (WIN); Tidal, *Brown* 178 (CAN, SASK). **Northwest Territories:** Aberdeen Lake, *Macpherson* 327 (CAN); Beverly Lake cabin, *Kuyt* 107 (CAN); Contwoyto Lake, *Thieret* 9415 (GH, US); Ennadai Lake, *Brown* 1320 (CAN); Gordon Lake, *Henderson* 19 (CAN); Great Bear Lake, *Porsild* 17117 (CAN), *Porsild & Porsild* 3429 (CAN), 3509 (CAN, US); Great Slave Lake, *Pike* (K); MacMillan Pass, *Porsild & Breitung* 11258 (CAN, GH, US); Maguse Lake, *Gussow* 33 (CAN); Nueltin Lake, *Harper & Porsild* 2211 (CAN, PH), 2246 (CAN), 2271 (MICH, MIN, PH), 2554 (MICH, MIN, NY); Small Tree Lake, *Maini & Swan* 506 (RM, SASK); Thelon Game Sanctuary, *Carroll* 65 (CAN); Yellowknife Highway, *Thieret & Reich* 7742 (CAN, MIN), 8121 (US). **Yukon:** Granite Mt., *Porsild & Breitung* 10576 (CAN, ISC, GH, US, WTU); Mayo Dist., *Bostock* 102 (CAN); McQueston Area, *Campbell* 493 (CAN); Mt. Sheldon, *Porsild & Breitung* 11094 (CAN, GH, US, WTU), 11485 (CAN, GH); pass between Teslin & Nisutlin R., *Porsild & Breitung* 11045 (CAN, NY), 11148 (CAN); St. Elias Mt., *Pearson & Porsild* 67-166A (CAN); Yukon-Mackenzie border, *Calder & Kukkonen* 27664 (ISC, NY); White Pass Summit, Bolton (US).

Plant and leaf size in *Kalmia microphylla* var. *microphylla* is controlled to some extent by the environment. In the typical alpine form the leaves are extremely small, usually less than 1.2 cm long. The type specimen, which represents this extreme, has leaves less than 1 cm long and is extremely short, less than 1 dm tall. At lower elevations the leaves are not uncommonly 2 cm long and the plant 2 dm tall. Rarely taller plants are found with leaves to 2.6 cm long. These larger leaved forms are superficially similar to *K. polifolia* and probably account for the variation in taxonomic treatment of *K. microphylla* in the past.

Kalmia microphylla and *K. polifolia* probably never come into contact with each other. In the Northwest Territories, however, the northern part of both their ranges, it is possible that the two taxa may occur together. The author has seen very few specimens of *K. polifolia* from the Northwest Territories, but this species is common in northern Alberta, Saskatchewan, and Manitoba. A few specimens of *K. microphylla* have been examined from the Northwest Territories, and this species extends all the way to the northwestern corner of Manitoba. No specimens, however, have been observed from Alberta or Saskatchewan. Sterile hybrids have been produced by crossing these two taxa (Jaynes, 1968a), but no specimens from northern Canada have been found that are morphologically similar to these hybrids.

The only other taxon with which *Kalmia microphylla* var. *microphylla* might be confused is *K. microphylla* var. *occidentalis*. Both taxa occur in western North America and their ranges overlap. The two are easily separated, however, since var. *occidentalis* has lanceolate leaves that are usually more than 2.5 cm long and 2½-4 times as long as broad, while var. *microphylla* has oval to eliptical leaves that are smaller and less than 2½ times as long as broad. Also, var. *occidentalis* has larger flowers, with the corolla more than 1.5 cm broad and the calyx 7-10 mm wide. Variety *microphylla,* by contrast, has smaller flowers, with the corolla less than 1.5 cm broad (usually less than 1.2 cm broad) and the calyx less than 7 mm wide.

Although both varieties are found in marshes, bogs, and other open wet areas, it appears that they rarely come into contact with one another. Of the var. *microphylla* specimens examined, most were collected at relatively high elevations according to the information available on the herbarium labels. The elevation at which this taxon was collected varied from an average altitude of 8,500 feet above sea level in California (5,200 to 11,500), to about 10,000 in Colorado, Nevada, Utah and Wyoming (7,000 to 12,500), to about 6,500 in Oregon (5,800 to 7,700), and to about 6,000 in Washington, Alberta and British Columbia (3,000 to 7,300). The altitudes in parentheses indicate the minimum and maximum elevations recorded from the labels. The information on the labels of specimens of var. *occidentalis* indicates that this species is found at lower elevations. Most of the specimens were from at or near sea level, but a few had been collected as high as 3,000 feet.

Kalmia microphylla var. *microphylla* and *K. microphylla* var. *occidentalis* apparently hybridize when they come into contact. A few specimens from Vancouver Island and the Cascade Mountains of Washington appear to be intermediate morphologically. These intermediate individuals are robust plants, 2-4 dm tall, similar in habit to the large-leaved var. *microphylla.* The leaves are 1.8-2.5 cm long, usually more ovate than lanceolate, and about twice as long as broad. The flowers are large, more typical of var. *occidentalis.* A few hybrids have been produced by crossing these varieties and they are highly fertile and set large quantities of seed (Jaynes, personal communication). Of the few suspected hybrids found, the pollen stainability varied from 10–90% normal pollen, indicating that some sterility occasionally results.

1b. **Kalmia microphylla** var. **occidentalis** (Small) Ebinger, comb. et stat. nov.

Kalmia occidentalis Small, N. Am. Fl. **29:** 53. 1914. TYPE: **Washington:** foothills of Mt. Rainier, 1883, *Mrs. Bailey Willis* (NY). *Kalmia polifolia* subsp. *occidentalis* (Small) Abrams, Ill. Fl. Pacific St. **3:** 302. 1951.

Sparingly branched shrub to 6 dm tall; leaves lanceolate, flat to slightly revolute margins, 2-4 cm long, some of the leaves always over 2 cm long and 2½-4 times as long as broad; calyx light pink, 7-10 mm broad; corolla usually rose-purple (rarely white), 1.5-2.0 cm broad; fruit 5-7 mm broad, 4.5-6 mm long; seeds 1-1.4 mm long.

Distribution: Along the western coast of North America from southern Alaska south to Oregon.

Common name: Western Swamp Kalmia; Western Bog Laurel.

REPRESENTATIVE SPECIMENS

UNITED STATES: **Alaska:** Admiralty Isl., *Hibber* 236 (UNM); Annette Isl., *Coville & Kearney* 381 (US); Douglas Isl., *Thorne* 10280 (UWM); Gravina Isl., *Anderson* 5352 (ISC), 2A599 (CAN, ISC); Kuiu Isl., *Rigg* 17 (WTU); Metlakatlan Isl., *Engstrom* (WTU); Mitkof Isl., *Brown* (ALA); Pleasant Isl., *Reiners* (HNH); Prince of Wales Isl., *Flett* 1976 (US); Revillagigedo Isl., *McCabe* 8590 (WTU); Woronkofski Isl., *Klein* 486 (ALA); Yakobi Isl., *Anderson* 1389 (US); Juneau, *Anderson* 6338 (ALA, BRY, CAN, GH, ISC, PH, RM, V); Mendenhall, *Anderson* 38 (CHRB); Petersburg, *Scamman* 515 (ALA, GH); Sitka, *Anderson* 160 (ISC, US); Wrangell, *Walker & Walker* 638 (CM, GH, NY, RM, US, WS); Yes Bay, *Gorman* 21 (K, NO, NY, US). **Oregon:** CLATSOP CO.: Gearhart, *Adair* (OSC); Knappa, *Bouch* (WTU); Delmoor, *Cooke* 10828 (OSC). **Washington:** GRAY HARBOUR CO.: Lake Quinault, *Thompson* 11429 (ALTA, GH, MONT, NY, PH, US, WS, WTU). ISLAND CO.: Whidbey Isl., *Smith* 480 (WS, WTU). KING CO.: Green Lake, *Benson* 1474 (WTU). MASON CO.: Lost Lake, *Jones* 6527 (PH, V, WTU). PACIFIC CO.: Ilwaco, *Foster* 865 (ORE, US). PIERCE CO.: Tacoma, *Sloan* (WTU). SAN JUAN CO.: Mt. Constitution, *Zeller & Zeller* 1193 (CM, GH, MIN, NY, US). SKAGIT CO.: Mt.

Higgins, *Thompson* 9639 (ND, US, WTU). SNOHOMISH CO.: Marysville, *Grant* (ARIZ, OAC, MU, RM, US). THURSTON CO.: Upper Valley of the Nisqually, *Allen* 4 (CAN, K, MIN, MSC, NY, US, WS). WHATCOM CO.: Custer, *Muencher & Muencher* 6007 (PH, US, WS).

CANADA: **British Columbia**: Aristazabal Isl., *McCabe* 3424 (WTU); Dewdney Isl., *Schofield* 70-27 (UBC); Goose Isl., *Martin & Guiquet* (V); Hope Isl., *Calder & Mackay* 31240 (CM, MIN); Lulu Isl., *Beamish & Vrugtman* 60519 (NY, OSC, UBC); Graham Isl., *Calder & Savile* 21349 (OSC, TRT, WS); Kunghit Isl., *Foster & Bigg* (UBC); Langara Isl., *Beebe* (V); Moresby Isl., *Calder & Taylor* 35771 (UBC); Prince Royal Isl., *McCabe* 3358 (WTU); Saltspring Isl., *Ashlee* (UBC, V); Vancouver Isl.: *Comox, Anderson* 483 (V); McCoy Lake, *Carter* 473 (US); Lost Lake, *Macoun* 618 (CAN, US); Port Hardy, *Racey* (UBC); Trout Lake, *Davidson* 6192 (UBC); Alice Arm, *Szczawinski* (V); Alouette R., *Garman* (V); Garibaldi Prov. Park, *Dow* D-2A-C (V); Haney, *Taylor* 1002 (UBC); Hope-Prince Hwy., *Brayshaw* 49470 (UBC); Kelsey Bay, *Calder & MacKay* 29204 (WTU); Kitsault, *Fisher* (UBC); New Westminster, *McCalla* 2944 (ALTA); Prince Rupert, *Mendel* 78 (V); Prudhomme Lake, *Taylor & Lewis* 618 (UBC); Terrace, *Szczawinski* (UBC, V).

Kalmia microphylla var. *occidentalis* has been considered specifically distinct only by Small (1914). In all floristic works of the west coast of North America this taxon has been considered a part of the eastern *K. polifolia,* although it has been rarely considered as a separate subspecies (Abrams, 1951). Hultén (1948) mentions that he was not able to separate the Alaskan specimens from those of Eastern America. He indicates, however, that a slight racial difference might exist, but that a large body of material would be necessary for a definite statement.

Kalmia microphylla var. *occidentalis* and *K. polifolia* are strikingly similar. Both have the same general habit and size, and except for a slight difference in flower size these structures are also the same. Under close morphological examination, however, these two species are easily separated. In *K. polifolia,* the leaf margins are usually revolute, and well developed stalked glands are present on both sides of the midrib. In *K. microphylla* var. *occidentalis,* by contrast, the leaves are not revolute, or only slightly so, and the stalked glands are absent. The two taxa also differ in seed size and calyx width. In *K. polifolia,* the seeds are long and narrow, 1.5-2.1 mm long, while the calyx varies in width from 5-7 mm. In *K. microphylla* var. *occidentalis,* the seeds are shorter and thicker, 1-1.4 mm long, and the calyx varies from 7-10 mm broad.

The geographic distribution of the two taxa also differs, and they never come into contact with one another. *Kalmia polifolia* is mainly an eastern species, occurring as far west as Saskatchewan and northeastern Alberta, while *K. microphylla* var. *occidentalis* occurs along the west coast from southern Alaska, south through British Columbia and from Washington to Oregon. Most of the specimens of var. *occidentalis* examined were from marshes, bogs and wet open areas at lower elevations from coastal areas and the islands off the coast of Alaska and British Columbia. Hultén (1968), who did not distinguish between these two species, shows this difference in distribution and also has an excellent drawing of *K. microphylla* var. ? *occidentalis* (as *K. polifolia* subsp. *polifolia*).

Cytologically, *Kalmia microphylla* var. *occidentalis* ($n = 12$) is more closely related to *K. microphylla* var. *microphylla* ($n = 12$) than it is to *K. polifolia* ($n = 24$). Crosses between var. *occidentalis* and *K. polifolia* result in triploid F_1 hybrids that produce less than 10% stainable pollen and no seeds (Jaynes, 1968a). In contrast, crosses between *K. microphylla* var. *microphylla* and var. *occidentalis* were highly fertile with the F_1's being intermediate between the two parents, producing viable seed and pollen that looked normal and fertile (Jaynes, personal communication).

Kalmia microphylla var. **occidentalis** f. **alba** Ebinger, forma nov.

Forma typicae habita statura etc. similis, floribus omnibus albis.

This white flowering form, which is similar to that found in some other species of *Kalmia,* has been collected at two different localities. **Alaska:** near Wrangell, *Mrs. J. C. Dart,* 1922. (US #1,118,961, Holotype). **British Columbia:** Lulu Island, peat bog between N. Westminster Highway and No. 4 road, *H. Rhodes, et al.,* 29 May 1954 (UBC).

2. **Kalmia polifolia** Wang., Schr. Berlin Ges. Naturf. Freunde 8: 130. 1788. TYPE: unknown.

Kalmia polifolia Ludwig, Neu. Wilde Baumz. 25. 1783. (nom. nud).

Kalmia glauca Loddiges ex Ludwig, Neu. Wilde Baumz. 25. 1783. (nom. nud.), Ait. Hort. Kew. 2: 64. 1789. TYPE: Plant growing in the Kew Gardens, (K).

Chamaedaphne glauca (Ait.) Kuntze, Rev. Gen. Pl. 2: 388. 1891.

Kalmia glauca var. *praecox* Lavallée Arbor. Segrez. 159. 1877. (nom. nud.).

Kalmia glauca var. *stricta* Jäger, Ziergeholze 279. 1865.

Kalmia glauca var. *superba* Makoy ex Bosse, Vollst. Handb. Blumengart. 2: 348. 1841. (nom. nud.), Jäger & Beissner, Ziergeholze 194. 1884. *Kalmia superba* K. Koch, Dendrologie 2(1): 154. 1872. (nom. nud.).

Kalmia rosmarinifolia Dum.-Cours. Bot. Cult. 2: 250. 1802. TYPE: unknown. *Kalmia glauca* β *rosmarinifolia* (Dum.-Cours.) Pursh, Fl. Am. Sept. 296. 1814. *Kalmia polifolia* var. *rosmarinifolia* (Dum.-Cours.). Rehd. in Bailey, Cycl. Amer. Hort. 2: 854. 1900.

Kalmia oleaefolia Dum.-Cours. Bot. Cult. ed. 2. 3: 322. 1811. (as synonym).

Sparingly branched shrub to 1 m tall; branchlets slightly flattened, 2-edged, glabrous or puberulent, commonly with decurrent ciliate lines from the petiole base; leaves opposite, subsessile with a broad petiole to 2 mm long, coriaceous, linear to oblong, the margins usually revolute, 1.5-4 cm long, 0.3-1.3 cm broad, 2½ to 4 times as long as broad, whitened beneath with small hairs, the midrib covered with purple clavate hairs on both surfaces; inflorescence a few-flowered, terminal corymbiform raceme, each flower on a glabrous pedicel 1.5-3 cm long, each pedicel subtended by a pair of bractlets in the axis of a leaf-like bract; calyx deeply 5-lobed, colorless to light pink, 5-7 mm broad, the lobes obtuse, margins ciliate; corolla rose-purple, 1.2-1.8 cm broad; anthers purple, 1-1.5 mm long; fruit subglobose, 4-7 mm broad, 4-6 mm long; seeds 1.5-2.2 mm long, the testa extending past the ends of the seed. Chromosome number $n = 24$.

Distribution: Bogs, swamps, and other wet, open areas from northeastern Alberta east to the Atlantic Ocean and south to the Great Lakes, Pennsylvania, New York and New Jersey.

Common name: Bog Laurel, Swamp Laurel, Pale Laurel, Gold Withy.

REPRESENTATIVE SPECIMENS

UNITED STATES: **Connecticut:** HARTFORD CO.: Suffield, *Harger* 6524 (ARIZ), *Blewitt* 3490 (PH). LITCHFIELD CO.: Bingham Pond, *Weber* 1489 (ISC). NEW HAVEN CO.: Middlebury, *Shepard* (CONN). **Maine:** ANDROSCOGGIN CO.: Livermore, *Gordon* 657 (MAINE). AROOSTOOK CO.: Knoles Corner, *Neal* 1908 (MAINE), *True* 6068 (PENN). CUMBERLAND CO.: Standish, *Rossbach* 5599 (ACAD, MAINE). FRANKLIN CO.: Mt. Abraham, *Rossbach* 5389 (MAINE). HANCOCK CO.: Mt. Desert Isl., *Redfield* 4266 (US). KENNEBEC CO.: Monmouth, *Hyland* 90 (MAINE). KNOX CO.: Rockland, *Rossbach* 1429 (ACAD). OXFORD CO.: Old Spec, *Richards* 6032 (MAINE). PENOBSCOT CO.: Orono, *Fernald* 349 (GH, MASS, MIN, MSC, ND, NY, PH, US). PISCATAQUIS CO.: Greenville, *True* 4701 (PAC), 4814 (PENN). SOMERSET CO.: Jackman, *True* 4668 (PENN). WALDO CO.: Northport, *Rossbach* 2499 (ACAD), 5349 (MAINE). WASHINGTON CO.: Jonesport, *Steinmetz* 844 (MAINE). YORK CO.: Sunken Pond, *True* 214 (GH, PENN). **Massachusetts:** BERKSHIRE CO.: Wolf Swamp, *Walters* (NHA). ESSEX CO.: Andover, *Steele* (MU). FRANKLIN CO.: Hawley, *Forbes* 24 (MASS). HAMPDEN CO.: Ludlow, *Seymour* 557 (DUKE, GH, MASS, NY). HAMPSHIRE CO.: Belchertown, *Torrey* (MASS). MIDDLESEX CO.: Concord, *Eaton* (MAINE). WORCESTER CO.: Worcester, *Dowling* 818 (NY). **Michigan:** ALCONA CO.: *Hall & Hagenah* 447 (BLH). ALPENA CO.: *Hatt* (BLH). BARAGA CO.: Baraga, *Richards* 1783 (MICH, NY), 2956 (MAINE, MICH). CHARLEVOIX CO.: Beaver Isl., *Reis* 906 (BLH, MSC). CHEBOYGAN CO.: Mud Lake, *Gleason, Jr.* 665 (DUKE, GH). CHIPPEWA CO.: Sugar Isl., *McVaugh* 8745 (BLH, CAN, MICH). CLARE CO.: Lake Station, *Dreisbach* 5650 (MICH). CRAWFORD CO.: Hartwick, *Bingham* (BLH). DELTA CO.: Bull Run Creek, *Hagenah* 6723 (BLH). EMMET CO.: Carp Lake, *Gates & Gates* 10334 (RM). GOGEBIC CO.: Watersmeet, *Voss* 7846 (MICH), 12472 (MICH). GRAND TRAVERSE CO.: Traverse City, *Dieterle* 1299 (CM, MICH). GRATIOT CO.: Alma, *Davis* (MONT). HOUGHTON CO.: Laurium, *Herman* 7591 (NY, US). IRON CO.: Golden Lake, *Voss* 4122 (MICH). KALKASKA CO.: Carlisle, *Hagenah* 4602 (BLH). KEWEENAW CO.: Mott Isl., *Bailey & Bailey* 4131 (MICH).

LEELANAU CO.: Maple City, *Thompson* L-1693 (BLH). LENAWEE CO.: Clinton, *Wood & Wood* (US). LUCE CO.: Spring Lake, *Hagenah* 1913 (BLH). MACKINAC CO.: *Hagenah* 4876 (BLH). MANISTEE CO.: Manistee, *Daniels* 4267 (MONT). MARQUETTE CO.: Turin, *Barlow* (NY). MIDLAND CO.: Sanford Game Preserve, *Dreisbach* 7941 (MICH). MONTMORENCY CO.: Barding Swamp, *Case* (MICH). OAKLAND CO.: Lakeville, *Farwell* 4905 (BLH). OGEMAW CO.: Clear Lake, *Case, Jr.* (MICH). ONTONAGON CO.: Berglund, *Beaman* 1848 (MS). OSCEOLA CO.: Evart, *Monaghan* (MSC). OSCODA CO.: *Zimmerman* 416 (MICH). OTSEGO CO.: Otsego Lake Village, *Voss* 10847 (MICH). ROSCOMMON CO.: Higgins Lake, *Denton* 1038 (MSC). ST. CLAIR CO.: Capac, *Dodge* (MU, TENN). SANILAC CO.: Minden City, *Voss* 8341 (MICH). SCHOOLCRAFT CO.: Long Lake, *Voss* 2657 (MICH). WEXFORD CO.: Cadillac, *House* 4660 (US). **Minnesota:** BELTRAMI CO.: Star Isl., *Butters & Rosendahl* 6584 (MIN). CARLTON CO.: Atkinson, *Lakela* 3550 (DUL, MIN). CASS CO.: Lake Kilpatrick, *Ballard* (ORE, RM, US, WS). CLEARWATER CO.: Long Lake, *Morley* 1106 (MIN). COOK CO.: Sea Gull Lake, *Lakela* 3669 (DUL, MIN). CROW WING CO.: Bay Lake, *Sheldon* 2172 (MIN). ITASCA CO.: Sand Lake, *Johnson* 2042 (PH), 2207 (GH, US). KANABEC CO.: Mora, *Moore & Tryon, Jr.* 17504 (MIN). KOOCHICHING CO.: Rainy Lake, *Moore & Moore* 11793 (ISC, MIN). LAKE CO.: Basswood Lake, *Lakela* 8898 (DUL). PINE CO.: Bruno, *Jerabek* 66 (MIN). ST. LOUIS CO.: Palo, *Nickelson* 2432 (ISC, NY, WS). **New Hampshire:** BELKNAP CO.: Crystal Lake, *Hodgdon & Steele* 9125 (NHA). CARROLL CO.: Church Pond, *Gale* (NHA). CHESHIRE CO.: Keene, *Gilbert* (NY, PH). COOS CO.: Mt. Washington, *Hartmann* 207 (NY); *Moore* 260 (GY), 1081 (GY). GRAFTON CO.: Mt. Lafayette, *Fernald & Smiley* 11839 (GH). HILLSBORO CO.: Peterborough, *Batchelder* 1891 (KY). ROCKINGHAM CO.: Derry, *Batchelder* (NHA). STRAFFORD CO.: Barrington, *Hodgdon & White* 11935 (NHA). SULLIVAN CO.: Springfield, *Hodgdon & Steele* 9128 (NHA). **New Jersey:** MORRIS CO.: Mt. Hope, *Edwards & Rusling* (CHRB). SUSSEX CO.: Kittatinney Ridge, *Griscom* 9562 (GH). **New York:** CHAUTAUQUA CO.: Petit, *Thurber* (GH). COLUMBIA CO.: Knickerbocker Lake, *McVaugh* 1013 (PENN). ERIE CO.: Protection, *Miller* 3764 (MSC). ESSEX CO.: Whiteface Mt., *Rudd* 824 (US). FRANKLIN CO.: Upper Savanac Lake, *Guest* 132 (PAC, PENN). HAMILTON CO.: Bern Bog, *Henry* (CM). HERKIMER CO.: Twin Lake, *VanPelt & Long* (PH). MADISON CO.: Recksport, *House* 6930 (US). ONEIDA CO.: White Lake, *True* 38 (PENN). ONONDAGA CO.: Labrador Pond, *Clausen* 2129 (NY, PAC, PENN). OSWEGO CO.: Mud Pond, *Wiegand* 13764 (GH). ST. LAWRENCE CO.: Norfolk, *Phelps* 757 (GH, NY, US). SARATOGA CO.: Saratoga Lake, *House* 27663 (PENN). SCHENECTADY CO.: Princetown, *Svenson* (GH). SULLIVAN CO.: Neversink, *Jones, Phillips & Stebbins* 21 (GH). TIOGA CO.: Owego, *Mapes* 4767 (GH). ULSTER CO.: Rockland, *Camp* 3036 (NY). WASHINGTON CO.: Salem, *Stewart* 63 (NY). **Pennsylvania:**

CARBON CO.: Albrightsville, *Pretz* 13321 (PH). LACKAWANNA CO.: Elmhurst, *Glowenke* 4820 (PENN). MONROE CO.: Tannerville, *Leeds* 2237 (MIN, PH). PIKE CO.: Shohola Falls, *Byhouwer & Kobuski* 226 (GH). SUSQUEHANNA CO.: Ararat, *Glowenke* 134 (PENN). WAYNE CO.: Lehigh Pond, *Adams* 3699 (GH). **Rhode Island:** PROVIDENCE CO.: Glocester, *Collins* (CONN, GH, MASS, NHA, NY, PENN, PH). **Vermont:** ADDISON CO.: Ripton, *Eggleston* 280 (GH). CALEDONIA CO.: Peacham, *Blanchard* (PH, US). CHITTENDEN CO.: Colchester, *Pringle* (BRY). LAMOILLE CO.: Mt. Mansfield, *Moseley* (MASS). ORLEANS CO.: Lake Willoughby, *Stevens* (US). RUTLAND CO.: Mt. Tabor, *Seymour* 24407 (BRY). WINDHAM CO.: *Tyson, Moldenke & Moldenke* 10263 (NY). **Wisconsin:** BAYFIELD CO.: Sand Bay, *Cheney* 6371 (UWM). DOOR CO.: Bailey's Harbor Ridge, *Shinners* (UWM). FLORENCE CO.: Spruce Lake, *Mau* (UWM). FOREST CO.: Crandon, *Palmer* 27776 (GY). IRON CO.: Mercer, *Salamun* 228 (UWM). JACKSON CO.: *Ketchum, Hartley & Morrissey* 9158 (ISC). KEWAUNEE CO.: *Gregor* (OS). LINCOLN CO.: Tomahawk, *Engel* (UWM). MARINETTE CO.: Walsh, *Throne* (UWM). MONROE CO.: La Grange Twp., *Hartley* 7884 (MIN). ONEIDA CO.: Three Lakes, *Wadmond* 2758 (MIN). RUSK CO.: Ladysmith, *Goessl* 2162 (UWM). SHAWANO CO.: Camp Tivol, *Keefe* (UWM). TAYLOR CO.: Buch Lake Area, *Piehl* (UWM). VILAS CO.: Eagle River, *Hollister* 334 (US). WASHBURN CO.: Spooner, *Cheney* 6135 (UWM).

CANADA: **Alberta:** Lake Athabaska: Smith Landing, *Preble & Preble* 99a (US); Alta, *Raupp & Abbe* 4529 (ALTA, CAN, MIN, PH). Gregoire Lake, *Dumais & Anderson* 2693 (ALTA); Richardson Lake, *Whitehorn & Barber* 185 (SASK). **Labrador:** Anatolak, *Sewall* 469 (GH, US), 471 (GH, US); Ashuanipi Lake, *Harper* 3877 (CAN, MIN, US); Attikamagen Lake, *Harper* 3501 (CAN, ISC, MIN, PENN); Battle Harbour, *Koelz* 36 (MICH, US); Cape St. Charles, *Potter & Brierly* 3410 (GH, NMC); Cartwright, *Hitchcock* 23818 (US); Gannet Isl., *Potter & Brierly* 3411 (GH); Goose Bay, *Gillett & Findley* 4931 (ACAD, NY); Gready Isl., *Bishop* 474 (GH), 475 (GH); Hopedale, *Walker* 370 (PENN); Mealy Mts., *Gillett & Findley* 5273 (ACAD, NY, TRT, US); Mills Harbour, *Cook* 88 (GH, US); Petty Harbour, *Bishop* 476 (CAN, GH); Spotted Isl., *Wallace* 42 (CONN); Sandwich Bay, *Woodworth* 329 (GH), 330 (GH); Windy Tickle, *Potter & Brierly* 3407 (MASS). **Manitoba:** Baralzon Lake, *Scoggan & Baldwin* 8216 (GH, MIN, WIN); Cranberry Portage, *Freedmann* (WIN); Churchill Dist., *Schofield* 1001 (DUL, GH, MIN, WS); Duck Lake, *Scoggan & Baldwin* 8245 (ALTA, CAN, GH); Gillam, *Punter* 97 (WIN); Goldesand Lake, *Keleher* 107 (WIN); Heming Lake, *Keleher* 159 (WIN); Herchnier, *Core* 215 (WVA); Lake Winnipeg, *Lowe* (WIN); Lake Winnipegosis, *Scoggan & Baldwin* 8152 (CAN); Nelson River, *Scoggan* 3016 (ALTA, CAN, MIN, WIN); Nueltin Lake, *Baldwin* 2180 (CAN, TRT, WIN, WS); Oxford Lake, *Scoggan* 5390 (CAN); Reindeer Lake, *Bald-*

win 2028 (CAN, TRT, WIN); Seal River, *Ritchie* 1794 (CAN, MIN); Third Cranberry Lake, *Freedman* (WIN); Wabowden, *Gillett* 2790 (US); Whiteshell Forest Reserve, *Scoggan* 8781 (ALTA, WIN); York Factory, *Punter* 134 (WIN). **New Brunswick:** ALBERT CO.: Grindstone Isl., *Christie* 1576 (NBM). CHARLOTTE CO.: Campobello Isl., *Malte* 955/29 (CAN). GLOUCESTER CO.: Bathurst, *Malte* 13 (CAN). KENT CO.: Little Forks Brook, *Squires & Squires* (NBM). MADAWASKA CO.: St. Leonard, *Malte* 605 (CAN). QUEENS CO.: Castaway, *Gorham & Squires* (NBM). SAINT JOHN CO.: Portland, *Matthew* (NBM). WESTMORELAND CO.: Sackville, *Fowler* (QUK). YORK CO.: Fredericton, *Dore & Gorham* 4569 (ACAD). **Newfoundland:** BONAVISTA SOUTH DIST.: Lethbridge, *Rouleau* 8363 (NFLD). BURGEO-LA POILE DIST.: Grandy Brook, *Fernald, Long & Fogg* 359 (GH, PENN, PH). FERRYLAND DIST.: Witless Bay, *Rouleau* 5391 (CAN, NFLD, US). FOGO DIST.: Fogo Isl., *Sornborger* (GH). FORTUNE BAY-HERMITAGE DIST.: Hermitage Bay, *Palmer* 1353 (GH, US). GRAND FALLS DIST.: Bishop Falls, *Fernald & Wiegand* 6023 (CAN, GH, K, NY, PH). HUMBER DIST.: Eagle's Nest Brook, *Rouleau* 3069 (NFLD). ST. BARBE DIST.: Trout R., *Rouleau* 3515 (NFLD). ST. MARY'S DIST.: Colinet, *Rouleau* 4175 (NFLD). ST. JOHN'S DIST.: Doctor Hill, *Fernald, Long & Fogg* 1916 (GH, PENN, PH, US). TRINITY NORTH DIST.: George's Brook, *Rouleau* 6078 (NFLD). WHITE BAY DIST.: Twin Lakes, *Rouleau* 6525 (NFLD, US). **Northwest Territories:** Baralzo Lake, *Scoggan & Baldwin* 8335 (CAN), 8379 (CAN); Gagnon Lake, *Scotter* 3162 (CAN); Ingalls Lake, *S.C.Z.* (CAFB). **Nova Scotia:** ANNAPOLIS CO.: Karsdale, *Johnson* (ACAD). CAPE BRETON CO.: Scatari Isl., *Ershine* 51-1167 (QUK). COLCHESTER CO.: Folleigh Lake, *Perry* (ACAD). CUMBERLAND CO.: Sand R., *Schofield & Webster* 5592 (ACAD). DIGBY CO.: Central Grove, *Fernald & Long* 24285 (GH). GUYSBOROUGH CO.: Tor Bay, *Eshbaugh* 522 (IND). HALIFAX CO.: *Fernald, et al.* 24284 (GH, PH). HANTS CO.: Mt. Uniacke, *Jack* 3230 (GH), 3231 (GH). INVERNESS CO.: Mackenzie Mt., *Rossbach* 4235 (ACAD). KINGS CO.: Caribou Bog, *Erskine* (ACAD). LUNENBURG CO.: Deep Cove, *Smith, et al.* 19604 (ACAD, QUK). PICTOU CO.: New Glasgow, *Dore & Gorham* 45-389 (ACAD). QUEENS CO.: Eagle Head, *Donly* 1009 (ACAD). RICHMOND CO.: Grand R., *Smith, et. al.* 10110 (ACAD, TRT). SHELBURNE CO.: Barrington, *Fernald, Long & Linder* 22154 (CAN, GH). VICTORIA CO.: Cape Breton Nat'l. Park, *Armstrong* 452 (QUK). YARMOUTH CO.: Yarmouth, *Pease & Long* 22152 (GH, PENN). **Ontario:** ALGOMA DIST.: Michipicoten Harbour, *Hosie, Harrison & Hughes* 1223 (CAN, TRT). CARLETON CO.: Mer Blue, *Porsild* 7743 (CAN). COCHRANE DIST.: Fraserdale, *Kirk* 75 (TRT); Timmins, *Baldwin* 4761 (CAN, TRT). DURHAM CO.: Newtonville, *Krug & Purchase* 473 (TRT). FRONTENAC CO.: Kingston, *Beschel* 10128 (QUK). GREY CO.: Euphrasia Twp., *Jackson* (TRT). HALIBURTON CO.: Dorset, *Walshe* 12 (CAN, TRT). HURON CO.: Wingham, *Anderson* 724 (TRT). KENORA DIST.: Richmond Gulf, *Abbe & Abbe* 3383 (CAN, MIN); Las Seul, *Baldwin* 8739 (CAN, MIN, QUK, TRT); Big Trout Lake, *Moir* 13 (MINN), 21 (CAN, MIN), 1744 (MIN); Swan Lake, *Moir* 156 (MIN); Fort Severn, *Moir* 1337 (CAN, MIN); Black Duck R., *Moir* 1831 (MIN), 2037 (CAN, MIN, TRT); Windigo R., *Cringan* P-26 (ACAD, TRT). MANITOULIN DIST.: Great Duck Isl., *Grassel* 6028 (NY). MIDDLESEX CO.: London, *Baker* 1638 (OAC). MUSKOKA DIST.: Huntsville, *Soper & Shields* 4927 (TRT), 4967 (TRT); Margaret Lake, *Chow* 6415 (TRT). NIPISSING DIST.: Algonquin Park, *Watson* 3967 (TRT). PARRY SOUND DIST.: Axe Lake, *Shields & Shields* 1640 (TRT). PEEL CO.: Heart Lake, *Catling & Sparling* (TRT). RUSSELL CO.: Bourget, *Heimburger* 2612 (TRT). SUDBURY DIST.: Skead, *Winterhalder* 66114 (CAN). THUNDER BAY DIST.: Bear Trap Lake, *Voss* 10361 (MICH, TRT). TIMISKAMING DIST.: Hilliard Twp., *Baldwin & Breitung* 2564 (CAN, SASK, TRT). WATERLOO CO.: Baden, *Montgomery* 997 (GH, OAC). WELLAND CO.: Humberstone, *Soper & Dale* 3776 (GH, MIN, TRT, US). WELLINGTON CO.: Puslinch, *Stroud* (TRT). YORK CO.: Vandorf, *Robb* (TRT). **Prince Edward Island:** KING CO.: Bothwell, *Fernald & St. John* 11148 (CAN, GH, US, WS). PRINCE CO.: North Point, *Erskine & Dore* 1080 (ACAD, NY). QUEENS CO.: Brackley Point Rd., *Fernald, Long & St. John* 7901 (CAN, GH, PH, US, WS). **Quebec:** ABITIBI CO.: Watson Lake Area, *Bentley* 58145 (TRT), 5837 (CAN, TRT). BERTHIER CO.: Lanoraie, *Scoggan* 1538 (CAN). BONAVENTURE CO.: Nouvelle, *Collins & Fernald* (GY). CHAMBLY CO.: Saint-Bruno, *M.-Victoria & R.-Germain* 43884 (CM, GH, ND, PH). CHICOUTIMI CO.: Lac Merlac, *Brisson* 63124 (CAN). GASPE WEST CO.: Mt. Albert, *Scoggan* 1086 (CAN). GATINEAU CO.: Eardley, *Cody & van Rens* 11167 (DUKE, GH, MSC, NY, TENN). HULL CO.: King Mt., *Zavitz* 1107 (TRT). HUNTINGTON CO.: Covey Hill, *M.-Victoria & R.-Germain* 43300 (GH). LABELLE CO.: Nominingue, *Roy* 1167 (WVA), 3650 (ACAD, CONN, NY, RM, US). LAKE ST. JOHN WEST CO.: Peribonka, *M.-Victorin* 15849 (GH). LEVIS CO.: St. Nicolas, *Cayouette & Cayouette* 54-82 (TRT). MAGDALEN ISLANDS CO.: Grindstone Isl., *Fernald, et. al.* 7900 (CAN, PH, WS). MATANE CO.: Montagne Lake, *Boivin* 787 (PENN). MATAPEDIA CO.: Sayabee, *Scoggan* 13600 (CAN). MEGANTIC CO.: Black Lake, *Fernald & Jackson* 12137 (GH). MONTCALM CO.: Lac Tapani, *Pennell* 16686 (PH). MONTMAGNY CO.: Lake Monroe, *R.-Germain & Courtemanche* 454 (US). PAPINEAU CO.: Notre Dame du Laus, *C.-Joseph* 8508 (ACAD). PONTIAC CO.: Danford Lake, *Dore* 19994 (TRT). QUEBEC CO.: Montmorency Fall, *Macoun* 68560 (GH). RIMOUSKI CO.: Father Point, *Bartram & Long* 581 (PH). SAGUENAY CO.: Fort Chimo, *Porsild* 21873 (CAN); Knob Lake, *Harper* 3350 (HNH, QUK); Cairn Isl., *Abbe, et. al.* 3067 (RM); Seven Isl., *Robinson* 868 (CAN, GH, NY); Mutton Bay, *Lewis* 582 (CAN). ST. JEAN CO.: Villeneuve, *M.-Victorin, et. al.* 43047 (MU). SHERBROOKE CO.: Orford, *Forest* 16058 (CAN, CM, QUK, SASK). TERREBONNE CO.: St. Janvier, *Scoggan* 314 (CAN). TWO MOUNTAINS CO.: Oka, *M.-Victorin* 3223 (NY, US). WOLFE CO.: Lac Aylmer, *Hamel* 13217 (CAN). **Saskatchewan:** Athabaska Lake, *Lang* 188 (US); *Raupp* 6175 (CAN, GH, NY), 6657 (GH), 6731 (GH, NY); Bittern Cr., *Wheaton* (CAFB); Candle Lake, *Boivin & Breitung* 6157 (NY); Cree Lake, *Maini* 21 (RM, SASK), 235 (SASK), 236 (CAN, RM, SASK); Crooked R., *Breitung* 70 (SASK); Cumberland House, *Argus* 4083 (SASK); Hatchet Lake, *Maini* 91 (OAC, RM, SASK); Nipawin Prov. Park, *Argus* 4122 (SASK); Orley, *Breitung* 268 (ALTA, CAN, NY, US); Prince Albert Nat'l. Park, *Fraser* (PAC, SASK); Stoney Rapids, *Maini* 205 (RM, SASK), 275 (SASK), 462 (RM, SASK); White Fox, *Fraser* (SASK); Windrum Lake, *Bryenton* 166 (CAN).

The name *Kalmia polifolia* was first used by Ludwig (1783), who gave it the common name Canada Laurel or Poley Leaved Laurel, but did not describe it. This name first appears with a valid description a few years later (Wangenheim, 1788). He gives its distribution as extending northward from 45 degrees latitude in America, Nova Scotia and the colder parts of Canada. His description, illustration, and the distribution leave no doubt as to the taxon referred to. Recently, Boivin (1967) suggested that the name be spelled *poliifolia* to conform to article 73 of the International Code of Botanical Nomenclature (Lanjouw, 1966). The name *K. glauca* was first used as a synonym of *K. polifolia* by Ludwig (1783) and later described by Aiton (1789). The type was based on a plant from Newfoundland growing at Kew. A specimen in the Kew Herbarium has written on the label "Kalmia glauca Hort. Kews. sp. nov. 1784" and probably represents the type of this name. *Kalmia rosmarinifolia* was used by Dumont de Courset (1802) to distinguish individuals that have narrow leaves with strongly revolute margins. Later, he listed the name as a synonym of *K. glauca* (Dumont de Courset, 1811).

Kalmia polifolia is found in bogs, swamps, and other wet places, commonly forming a border around ponds and lakes. In bogs, its roots usually form dense mats that extend out over the water. It is also found at higher elevations in the mountains of northeastern United States and Canada. This species is the most widely distributed member of the genus, extending from northeastern Alberta, across Canada to the east coast and south to New Jersey. Its entire range, however, is hard to determine with certainty. There are two reports of its occurrence as far north as the Arctic Circle in the Northwest Territories (Gussow, 1933, and Thieret, 1963). Both of these (Maguse Lake, *Gussow* 33; Contwoyto Lake, *Thieret* 9415) are specimens of *K. microphylla* var. *microphylla.* The only specimens of *K. polifolia* seen from the Northwest Territories are from the extreme southern part (Scotter, 1966). In the Great Lakes region this taxon extends as far south as northern Illinois (Fuller, 1944), and along the east coast to New Jersey (Griscom, 1931). This species has also become naturalized in Europe since Scott (1962) reported that it has been collected from Flanders Moss, Perthshire, Scotland.

Besides leaf size and shape, the character most commonly used by previous authors to separate *Kalmia polifolia* from *K. microphylla* is revolute leaf margins. In *K. microphylla,* the leaf margins are not revolute, or only slightly so, while in *K. polifolia* the margins are usually strongly revolute. This characteristic is somewhat variable. In about 80% of the specimens examined, the leaf margins were strongly revolute, resulting in a narrow, linear leaf. In the remaining specimens, some lacked revolute margins entirely, while in others the younger leaves were revolute while older leaves were not. The variability of this characteristic is responsible, in part, for the confused taxonomic status of *K. microphylla.*

The major distinguishing vegetative character that separates *Kalmia polifolia* from the related species, *K. microphylla,* is the presence of purple clavate hairs on the leaf midrib. Boivin (1968) appears to be the first to have made use of this character when he separated variety *microphylla* from variety *polifolia.* He mentions, however, that west of Alberta the distinction of the two varieties becomes meaningless, as most of the British Columbia material is intermediate, the leaves being long and narrow like variety *polifolia,* but glandless on the midrib. It appears that he was confusing *K. polifolia* with the western *K. microphylla* var. *occidentalis,* which is similar vegetatively, except for the glandless midribs. Clavate glands were found on all specimens of *K. polifolia* examined. These glands vary in size, shape and color, and are more plentiful on some specimens than on others. The glands average about 0.3 mm long, are colorless near the base and become deep purple to black toward the swollen apex. In some specimens, however, they are nearly colorless throughout, and in others barely expanded above. Also, their distribution varies, being more common on some leaves than on others. On older leaves, it is not uncommon to find that many of the glands have broken off. The glands on the upper side of the midrib are commonly shorter, darker colored and not as obvious as those on the under side of the leaf. For determining the presence of these glands it is best to look at the developing leaves.

Morphologically and genetically *Kalmia polifolia* ($n = 24$) is most closely related to *K. microphylla* ($n = 12$). The F_1 of a cross between these two species is a highly viable triploid which has a pollen stainability of 0-15% (Jaynes, 1968a). These similarities suggest that these two taxa have probably become specifically distinct as a result of the last ice age and the resulting development of a tetraploid taxon from a wide ranging ancestral diploid species. Jaynes (1969) suggested that these taxa should be considered separate species based on his cytological and genetic studies. *Kalmia polifolia* can also be crossed with other members of the genus, but few viable offspring are produced.

Kalmia polifolia forma **leucantha** Schofield & Smith, Canad. Field Nat. **67**: 94. 1953. TYPE: **Newfoundland:** near Hodgewater Line, Trinity South, *E. E. Smith* and *A. C. Smith* 1055 (ACAD).

This white flowering form, which is similar to that found in some of the other species of *Kalmia,* is known from one collection. This single specimen was found in a bog where the typical form was very common.

3. **Kalmia latifolia** Linnaeus, Sp. Pl. **1**: 391. 1753.
TYPE: "Habitat in Marilandia, Virginia, Pennsylvania" (LINN 560.1, lectotype, specimen at the top right).

Chamaedaphne latifolia (L.) Kuntze, Rev. Gen. Pl. **2**: 388. 1891.

Kalmia latifolia var. *acuminata* Raf. Medical Fl. **2**: 17. 1830. (nom. nud.).

Kalmia latifolia var. *alba* Raf. Medical Fl. **2**: 17. 1830. *Kalmia latifolia* f. *alba* (Mouillefert) Rehd. Rhodora **12**: 2. 1910.

Kalmia latifolia var. *arborea* Raf. Medical Fl. **2**: 17. 1830 (nom. nud.).

Kalmia latifolia var. *pavarti* André, Revue Hort. **60**: 541. 1888.

Kalmia latifolia f. *rubra* K. Koch, Dendrologie 2(1) : 152. 1872. *Kalmia latifolia* var. *rubra* (K. Koch) Rehd. in Bailey, Cycl. Amer. Hort. **2**: 854. 1900.

Kalmia latifolia var. *ternata* Raf. Medical Fl. **2**: 17. 1830.

Kalmia latifolia var. *laevipes* Fern. Rhodora **42**: 53. 1940. TYPE: **Virginia**: NORFOLK CO.: dry woods of a "hammock", Great Dismal Swamp, west of Yadkin, *Fernald & Long* 11101 (GH).

Kalmia lucida K. Koch, Dendrologie 2(1) : 152. 1872. (as synonym).

Kalmia nitida Forbes, Hort. Woburn. 93. 1833. TYPE: unknown, probably a living plant.

Much branched shrub to 4 m tall (rarely a small tree); branchlets terete, reddish brown, becoming gray, stipitate-glandular to glabrous; leaves alternate (appearing nearly whorled on slow growing twigs), flat, coriaceous, elliptic to elliptic-lanceolate, 4-12 cm long, 1.5-4 (rarely 5) cm wide, dark green and glabrous above, light green to reddish brown and with short glandular hairs beneath, apex acute, base narrowly cuneate, midrib puberulent above; petiole 1-3 cm long, glabrous to puberulent, sometimes glandular-stipitate; inflorescence a terminal, compound corymb; pedicels 2-4 cm long, puberulent to stipitate-glandular, often floccose, viscid (rarely glabrous), subtended by 2 bracteoles in the axil of a puberulent, lanceolate bract, 1-5 mm long; major inflorescence branches puberulent, usually stipitate-glandular, to 4 cm long; calyx glabrous to stipitate glandular, green to reddish, 5-8 mm broad, the lobes usually oblong, acute; corolla usually light pink (white to deep red) with purple spots around each anther pocket, usually lightly stipitate-glandular outside, puberulent inside, 1.5-3 cm broad; style 1-1.8 cm long; anthers dark purple to brown, 1.2-1.7 mm long; filaments puberulent; capsule depressed globose, stipitate-glandular, 4-7 mm broad, 3-5 mm long; seeds .7-1 mm long, the testa loose and extending slightly past the ends of the seed.

Distribution: Mostly rocky or sandy hardwood forests in eastern United States from southern Maine, west through southern New York to central Ohio, south to southern Mississippi, Alabama, and Georgia and northwestern Florida.

Common Name: Mountain Laurel, Broad-leaved Laurel, Calico-bush, Spoonwood, Ivy, Mt. Ivy, Big-leaved Ivy, Laurel-leaves, Calmoun.

REPRESENTATIVE SPECIMENS

Alabama: CALHOUN CO.: *Pendergrass* (TENN). CHEROKEE CO.: Centre, *Clonts* 95 (ISC). CHOCTAW CO.: Silas, *McDaniel* 4218 (VDB). CLARKE CO.: Tallahatta Creek, *Kral* 19749 (VDB). CLEBURNE CO.: *Kral* 31843 (VDB). CONECUH CO.: Castleberry, *Howell* 760 (US). CULLMAN CO.: Cullman, *Kral* 28911 (VDB). DALE CO.: Newton, *Godfrey* 55477 (TENN). DE KALB CO.: Mentone, *Demaree* 50521 (TENN). ESCAMBIA CO.: Little Escambia River, *Ahles* 7229 (MISSA). FRANKLIN CO.: Russellville, *Kral* 26321 (VDB). HENRY CO.: Headland, *Wiegand & Manning* 2370 (CU). JACKSON CO.: Flat Rock, *Kral* 34948 (VDB). LEE CO.: Chewacla, *Barnes* 119 (VDB). MARION CO.: Hackelberg, *Kral* 20024 (VDB). MARSHALL CO.: Albertville, *Harbison* 15887 (TENN). MOBILE CO.: Mt. Vernon, *Burnham* 84 (VDB). PIKE CO.: Troy, *McDaniel* 7830 (VDB). TUSCALOOSA CO.: Lake Nichols, *Williams* 104 (VDB). WASHINGTON CO.: Bates Creek, *Segars* 191 (WVA). WINSTON CO.: Haleyville, *Kral* 29476 (VDB). **Connecticut:** FAIRFIELD CO.: Wilton, *Eames* 10426 (CONN). HARTFORD CO.: Windsor, *Ahles* 65351 (MASS). LITCHFIELD CO.: Preston, *Lumsden* (MU). MIDDLESEX CO.: Millers Pond, *North* 51 (MICH, US). NEW HAVEN CO.: Milford, *Eames* 2813 (CONN). NEW LONDON CO.: Lantern Hill, *Glea-*

son (DUKE). TOLLAND CO.: Andover, *Travis* 2408 (CONN). WINDHAM CO.: Crystal Lake, *Peterson* (CU). **Delaware:** NEW CASTLE CO.: Arden, *Travis* 1086 (PENN). SUSSEX CO.: Gumboro, *Beaven* 241 (DUKE). **Florida:** ESCAMBIA CO.: McDavid, *Goodale* (MASS). GADSDEN CO.: Sycamore, *Godfrey* 61925 (MSC). HOLMES CO.: Darlington, *Godfrey* 55498 (TENN). LIBERTY CO.: Greensboro, *Karl* 1916 (TENN). OKALOOSA CO.: Laurel Hill, *Godfrey* 61284 (US). WALTON CO.: De Funiak Springs, *Perkins & Hall* 2510 (CU). **Georgia:** CLARK CO.: Middle Oconee River, *Duncan & Duncan* 4358 (ID, IND, ISC, PENN, RENO, TENN, US). CLAY CO.: Cemochechahee Creek, *Thorne* 3453 (CU). DADE CO.: Lookout Mt., *McVaugh* 9023 (MICH). EARLY CO.: Sawhatchee Creek, *Duncan & Thorne* 1778 (CU, TENN). EFFINGHAM CO.: Savannah River, *Harper* 1814 (US). GWINNETT CO.: McGuires Mill, *Small* (US). MORGAN CO.: Hard Labor Creek St. Park, *Jones* 15456 (VDB). PICKENS CO.: Jasper, *Cronquist* 4483 (NO, US). RABUN CO.: Darling Spring, *J.H.M.* E1525 (WVA). RANDOLPH CO.: Cuthbert, *Harbison* 13729 (TENN). SCREVEN CO.: Newington, *Cronquist* 5023 (MICH, US, WS). SUMTER CO.: Americus, *Harper* 523 (US). UNION CO.: Vogel St. Park, *McVaugh & Pyron* 841 (ORE). UPSON CO.: Flint River, *Browne & Browne, Jr.* 6587 (KY). WALKER CO.: Pigeon Mt., *Wilson* 176 (US). WALTON CO.: Athens, *Cronquist* 4468 (MICH, NO, US). WHITE CO.: Cleveland, *Lovett* (DUKE). WHITFIELD CO.: Dalton, *Cronquist* 5045 (MICH, US, WS). **Indiana:** CLARK CO.: Borden, *Deam* 24495 (IND, MIN). CRAWFORD CO.: Riddle, *Deam* 16497 (IND). PERRY CO.: Derby, *Ramsey* 10876 (IND). **Kentucky:** BELL CO.: Pike Mt. St. Park, *Collins* 180 (KY). BREATHITT CO.: Robinson Forest, *Smith* 1726 (KY). CARTER CO.: Cascade Cavern, *Gilbert & McCoy* 3513 (US). CASEY CO.: Liberty, *Wharton* 4366 (KY). EDMONSON CO.: Mammoth Cave Nat'l. Park, *Pittillo* 2452 (KY). ESTILL CO.: South Irvine, *Wharton* 2298b (KY, MICH). FLEMING CO.: Plummer's Mill, *Wharton* 3873 (KY). FLOYD CO.: Hueysville, *Centers & Blair* 77 (KY). GRAYSON CO.: Clifty Creek, *Browne & Browne, Jr.* 6494 (KY). HARLAN CO.: Poor Fork, *Kearney* 182 (ISC, MSC, OS, US). JESSAMINE CO.: Camp Daniel Boone, *Webb* 104 (KY). KNOTT CO.: Littcarr, *Smith* 59 (KY). LETCHER CO.: *Browne & Browne, Jr.* 5400 (KY). LEWIS CO.: Vanceburg, *Wharton* 5012 (KY, MICH). LINCOLN CO.: Ottenheim, *Wharton* 4866 (KY, MICH). MCCREARY CO.: Cumberland Falls, *Rogers* 55 (DUKE, IND, MIN, PENN, TENN, US, WVA). MADISON CO.: Berea, *Nelson* (MICH, MIN, MU). MENIFEE CO.: Frenchburg, *McInteer* 2302 (KY). MORGAN CO.: Ezel, *Oldfield* 57 (KY). POWELL CO.: Stamping Ground, *Singer* (BRY). PULASKI CO.: Mt. Victory, *Warden* 129 (KY). TODD CO.: Clifty, *McCoy* (WVA). TRIMBLE CO.: Bedford, *Born* (KY). WOLFE CO.: Sky Bridge, *McInteer* 1055 (KY). **Louisiana:** WASHINGTON PARISH: Bogalusa, *Cocks* (NO); Varnodo, *Thieret* 23481 (DUKE).

Maine: CUMBERLAND CO.: Richville, *Hyland* 444 (MAINE). OXFORD

CO.: Fryeburg, *Hyland* 446 (MAINE). PENOBSCOT CO.: Carmel, *Harvey* 622 (US). SAGADAHOC CO.: Phippsburg, *Gordon* 592 (MAINE). WASHINGTON CO.: Cherryfield, *Hyland* 760a (MAINE). YORK CO.: Kennebunk, *Hyland* 252 (MAINE). **Maryland:** ALLEGANY CO.: Cumberland, *Richards* 128 (MAINE). ANNE ARUNDEL CO.: Camp Whippoorwill, *Grimes* (WVA). BALTIMORE CO.: Abingdon, *Nieuwland* (ND). CAROLINE CO.: Newton, *Quidas* 37 (MAINE, PENN). CECIL CO.: Elkton, *Randolph & Randolph* 124 (CU). FREDERICK CO.: Hunting Creek, *Earle* 1872 (PENN). GARRETT CO.: Grantsville, *Stone* 14111 (PENN). KENT CO.: Chestertown, *Vanatta* (CHRB). PRINCE GEORGE CO.: Suitland, *Meyer* 9178 (ISC, WVA). QUEEN ANNES CO.: Chester River, *Thatcher* 5 (MIN). ST. MARY'S CO.: Patuxent River, *Grether* 8276 (MICH). TALBOT CO.: Easton, *Earle* 810 (PENN). WASHINGTON CO.: Boonsboro, *Tidestrom* 724a (US). WICOMICO CO.: Sharptown, *Tidestrom* 12228 (MICH). WORCESTER CO.: Ferry Creek, *Redmond* 225 (MICH). **Massachusetts:** BERKSHIRE CO.: Williamstown, *Ames* (MICH). BRISTOL CO.: New Bedford, *Bartlett* 319 (IND, MICH). ESSEX CO.: Newburyport, *Mock* (NHA). FRANKLIN CO.: Mt. Toby, *Elwell* (MASS). HAMPDEN CO.: Granville, *Seymour* 197 (MASS). HAMPSHIRE CO.: Amherst, *Elwell* (MASS). MIDDLESEX CO.: Concord, *Mann* (HNH). NORFOLK CO.: Dedham, *Greenman* 2371 (MIN). PLYMOUTH CO.: Plymouth, *Morong* 1184 (US). WORCESTER CO.: Brookfield, *Markert* (MASS). **Mississippi:** CLARKE CO.: Burstone Cuesta, *Jones* 12050 (VDB). FORREST CO.: McCallum, *Ray, Jr.* 6045 (MISSA). GEORGE CO.: Cedar Creek, *Demaree* 35222 (VDB). HARRISON CO.: Gulfport, *Bomhard* 33 (NO). HINDS CO.: Natchez Trace Parkway, *Price* (MISSA). JACKSON CO.: Van Cleave, *Demaree* 32454 (DUKE). JASPER CO.: Rose Hill, *Reynolds* 96 (MISSA). LAUDERDALE CO.: Meridian, *Hayes* 20 (MISSA). LINCOLN CO.: Boque Chitto, *Ray, Jr.* 7830a (MISSA). PEARL RIVER CO.: Picayune, *Ray, Jr.* 6519 (MISSA). STONE CO.: Perkinson, *Ray, Jr.* 7713 (MISSA). TISHOMINGO CO.: Fisherman Ford, *Ray, Jr.* 7507 (MISSA, VDB). WAYNE CO.: Clara, *Graham* 118 (MISSA). **New Hampshire:** BELKNAP CO.: Center Harbor, *Hodgdon, et. al.* 9507 (NHA). CARROLL CO.: Albany, *Pease* 25358 (MAINE). CHESHIRE CO.: Fitzwilliam, *Hodgdon* 7069 (HNA). GRAFTON CO.: Hanover, *Drew* (HNH). HILLSBORO CO.: Manchester, *Hodgdon & Kent* 7070 (NHA). MERRIMACK CO.: Hooksett, *Hall* (NHA). ROCKINGHAM CO.: Windham Center, *Harris* 430 (NHA). STRAFFORD CO.: Farmington, *Lord* (NHA). **New Jersey:** ATLANTIC CO.: Alsion, *Crow* 126 (MSC). BERGEN CO.: Palisades, *Gershoy* (CU). BURLINGTON CO.: Pemberton, *Palmer* 39752 (MICH, MIN). CAMDEN CO.: Gibbsboro, *Hynes* (PENN). CAPE MAY CO.: Dennisville, *Fender* 5049 (PENN). CUMBERLAND CO.: Gouldtown, *Long* 575 (ARIZ, CAN, CU, IND, ISC, KY, NHA, NO, TENN, UARK, WVA). ESSEX CO.: Millburn, *Rusby* 1710 (MICH). GLOUCESTER CO.: Mantua, *Adams* 258 (PENN). HUNTERDON CO.: Fairmount, *Good* (CHRB). MIDDLESEX CO.: Spotswood, *Laugh-*

ridge & Chrysler (CHRB). MONMOUTH CO.: Clarksburg, *Fogg, Jr.* 14129 (PENN). MORRIS CO.: Longwood, *Davidson* 764 (CHRB). OCEAN CO.: South Lakewood, *MacKenzie* 3116 (US). PASSAIC CO.: Uttertown Bog, *Montgomery* (CHRB). SALEM CO.: Auburn, *Fogg, Jr.* 6606 (CHRB, PENN). SOMERSET CO.: Willowood estate, *Blackburn* (CHRB). SUSSEX CO.: Kittatinny Ridge, *Davidson* 1509 (CHRB). WARREN CO.: Sand Pond, *Large & Clausen* 1280 (CU). **New York:** BRONX CO.: Bronxdale, *Burnham* 428 (CU). CATTARAUGUS CO.: Rock City Park, *Muenscher* 15841 (CU). CHEMUNG CO.: Susquehana River, *Lucy* 6616 (MU). COLUMBIA CO.: Ghent, *McVaugh* 881 (PENN). DELAWARE CO.: Deposit, *Muenscher* 16244 (CU). DUTCHESS CO.: *Clove, Standley & Bollman* 12138 (US). GREENE CO.: Winter Clove Mt., *Gershoy* (CU). NASSAU CO.: Woodbury, *Stewart* (CU). ONEIDA CO.: New London, *House* 27859 (CU). RICHMOND CO.: Haverstraw, *Fosberg & Fosberg* 14897 (PENN). ROCKLAND CO.: Ramapo, *Gershoy* (CU). SCHUYLER CO.: Cayuta Lake, *Muenscher & Brown* 21703 (CU). STEUBEN CO.: Painted Post, *Muenscher* 15842 (CU). SUFFOLK CO.: Southampton, *St. John* 2852 (CU). SULLIVAN CO.: Camp Ranachqua, *Weber* 272 (ISC). TIOGA CO.: Spencer, *Eames & McDaniels* 4765 (CU). TOMPKINS CO.: Enfield, *Palmer* 928 (IND). ULSTER CO.: Lake Minnewaska, *Gillis* 3090 (MSC). WESTCHESTER CO.: Ossining, *Gershoy* (CU, MU).

North Carolina: ALEXANDER CO.: *Keever* 21 (DUKE). BUNCOMBE CO.: Asheville, *McCarthy* (US). BURKE CO.: Shortoff Mt., *Wilbur* 7004 (VDB). CALDWELL CO.: Granite Falls, *Randolph & Randolph* 1085 (CU). CHATHAM CO.: *Costello* 14 (DUKE). CLAY CO.: Perry Gap Road, *Wilbur* 1275 (MIN, DUKE). CUMBERLAND CO.: Rockfish Creek, *Correll & Rankin* 9053 (DUKE). DURHAM CO.: Catsburg, *Wilbur* 12230 (DUKE). EDGECOMBE CO.: Tar River, *Fox & Whitford* 1746 (DUKE). FORSYTH CO.: *Schallert* 1092 (DUKE). GASTON CO.: Kings Mt., *Oosting* 1646 (DUKE). GRAHAM CO.: Thunderhind Mt., *Beardslee & Kofoid* (MU). GRANVILLE CO.: Tar River, *Correll* 516 (DUKE, MASS). HARNETT CO.: Bunnlevel, *Laing* 1104 (MIN). HAYWOOD CO.: Waynesville, *Standley* 5401 (US). HENDERSON CO.: Hendersonville, *Cottam* 11140 (UT). JACKSON CO.: Wesner Bald, *Ramseur* 171 (MAINE). JOHNSTON CO.: Neuse River, *Fox & Whitford* 1293 (DUKE, WS). LEE CO.: Deep River, *Beard* 405 (KY). MCDOWELL CO.: *Rogers* 8358 (DUKE, US). MACON CO.: Mt. Satula, *Harbison* 1848 (TENN). MADISON CO.: Hot Springs, *Wehmeyer* 533 (MICH). MITCHELL CO.: Roan Mt., *Cannon* 143 (CU). MOORE CO.: Carthage, *Harriot* (NO). ORANGE CO.: Hillsboro, *Correll* 325 (DUKE). POLK CO.: Columbus, *Townsend* 236 (CU). ROCKINGHAM CO.: Smith River, *Correll & McDowell* 10695 (DUKE). SCOTLAND CO.: Laurel Hill, *Wiegand & Manning* 2369 (CU). STANLY CO.: Badin, *Fox, Godfrey & Boyce* 1427 (DUKE, TENN, US, WS). STOKES CO.: Sauratown Mt., *Radford* 34665 (ISC). SURRY CO.: Pilot Mt., *Williams* 296 (DUKE). SWAIN CO.: Andrews Bald, *Bruhn* 4 (TENN). TRANSYLVANIA CO.:

Rosman, *Morley* 891 (ISC). UNION CO.: Rocky River, *Ahles & Haesloop* 31521 (UARK). WAKE CO.: Raleigh, *Godfrey* 3765 (US). WATAUGA CO.: Boone, *Ahles & Duke* 43728 (PAC). WAYNE CO.: Mt. Olive, *Rose* 36 (MASS). WILKES CO.: *Wyatt* 832 (ARIZ, BRY, NHA, VDB). **Ohio:** ADAMS CO.: Mineral Springs, *Herrick* (OS). ATHENS CO.: Athens, *Kellerman* (OS). COLUMBIANA CO.: *Sanders* (OS). COSHOCTON CO.: New Castle Twp., *Selby* (OS). CUYAHOGA CO.: Bayville, *Biebel* (OS). FAIRFIELD CO.: Sugar Grove, *Potzger* 2969 (ND). GALLIA CO.: *Jones* (OS). GUERNSEY CO.: Liberty Twp., *Thomas* (OS). HOCKING CO.: Clear Creek, *Stuckey* 2912 (OS). HOLMES CO.: Killbuck Twp., *Herrick* (OS). JACKSON CO.: Liberty Twp., *Bartley & Pontius* (OS). JEFFERSON CO.: Amsterdam, *Cusick* (OS). KNOX CO.: Pipesville, *Moldenke* 12186 (OS). LAWRENCE CO.: Hanging Rock, *Werner* (OS). LICKING CO.: Blackland Gorge, *Stuckey* 6603 (OS). MEIGS CO.: Columbia Twp., *Jones* (OS). MONROE CO.: Adams Twp., *Thomas* (OS). MORGAN CO.: Bur Oak St. Park, *Herrich* (OS). MUSKINGUM CO.: Laurel Hill, *Reed* (OS). PERRY CO.: Jonathan Creek, *Hicks & Dambach* (OS). PIKE CO.: Chimney Rocks, *Crowl* (OS). ROSS CO.: Tar Hollow, *Crowl* (OS). SCIOTA CO.: Cooper Head Fire Tower, *Demaree* 10664 (OS). TUSCARAWAS CO.: Wayne Twp., *Brown* (OS). VINTON CO.: Lake Hope St. Park, *Stuckey* 6407 (OS). WASHINGTON CO.: Vincent, *Walpole* 1129 (BLH). **Pennsylvania:** ADAMS CO.: Birch River, *Tanger* 4434 (PENN, WS). ALLEGHENY CO.: Tom's Run Rd., *Henry & Buker* (PENN). ARMSTRONG CO.: Sherrett, *Henry* (PENN). BEDFORD CO.: Tatesville, *Berkheimer* 982 (PENN). BERKS CO.: Bechtelsville, *Fender* 1022 (PENN). BLAIR CO.: Blue Knob, *Westerfeld* 16177 (PAC). BRADFORD CO.: Canton, *Westerfeld* 907 (PAC, PENN). BUCKS CO.: Janney, *Long* 76067 (PENN). BUTLER CO.: Clintonville, *Brubaker* 2537 (PENN). CAMBRIA CO.: Johnstown, *Tinan* (OS). CAMERON CO.: Sinnemahoning Creek. *Fogg, Jr.* 11555 (PENN). CARBON CO.: Little Gap, *Fogg, Jr.* 11900 (MIN, PENN). CENTRE CO.: Yarnell. *Keener* 2581 (PAC). CHESTER CO.: Harmonyville, *Fender* 1401 (PENN). CLARION CO.: Callensburg. *Wood. Jr.* 2170 (PENN). CLEARFIELD CO.: Troutville, *Ehrle* 2475 (PAC). CLINTON CO.: Booneville. *Wahl* 3198 (PAC). COLUMBIA CO.: Mill Grove. *Pohl* 2554 (PENN). CUMBERLAND CO.: Shippensburg, *Saxe, Jr.* 36 (PENN). DAUPHIN CO.: Pillow. *Berkheimer* 12883 (PAC, PENN). DELAWARE CO: Darby. *Baker* (PAC). ELK CO.: Medix Run, *McClelland* (PENN). FAYETTE CO.: Wymps Gap. *Buvinger* (PENN). FOREST CO.: Brookston. *Shields* D-2157 (PAC). FRANKLIN CO.: Mercersburg. *Kriner* 104 (PAC). FULTON CO.: Deneen Gap. *Westerfeld* 7798 (PAC. PENN). GREENE CO.: Jefferson. *Wherry & Bell* (PENN). HUNTINGDON CO.: Maddensville, *Westerfeld* 9823 (PAC). JEFFERSON CO.: Sigel, *Wahl* 10944 (PAC). JUNIATA CO.: Cross Keys. *Westerfeld* 14535 (PAC). LACKAWANNA CO.: Montdale. *Adams* 3542 (PENN). LANCASTER CO.: Collins, *Brubaker* 1521 (PENN). LAWRENCE CO.: McConnells Mills, *Russell* 1582 (PENN). LEBANON CO.: Cold Spring, *Travis* 1170 (PENN). LUZERNE CO.: Mountaintop, *Adams* 3484 (PAC). LYCOMING CO.: Cedar Run, *Wahl* 19261 (PAC). MIFFLIN CO.: Standing Stone Creek, *Westerfeld* 3961 (PAC). MONROE CO.: Scotrun, *Niering* 1214 (PAC). MONTGOMERY CO.: Audubon, *Wherry* (PENN). NORTHAMPTON CO.: Wind Gap, *Schaeffer, Jr.* 18252 (PENN). NORTHUMBERLAND CO.: Sunbury, *Wagner* 8987 (PENN). PERRY CO.: Bloomfield, *Adams & Thebes* 1232 (PENN). PIKE CO.: Porter's Lake, *DePue* 136 (PAC). SCHUYLKILL CO.: Delano, *Wagner* 3227 (PENN). SNYDER CO.: Paxtonville, *Wade* 783 (PENN). SOMERSET CO.: Jennerstown, *Fogg, Jr.* 15258 (PENN). SULLIVAN CO.: Laporte, *Westerfeld* 381 (PAC, PENN). SUSQUEHANNA CO.: North Knob, *Adams* 3612 (PENN). TIOGA CO.: Mainesburg, *Fender* 1537 (PENN). UNION CO.: Laurelton, *Ludwig* 1521 (PAC). VENANGO CO.: Franklin, *Wahl* 12633 (PENN). WARREN CO.: Irvington, *Moldenke* 17479 (ND). WAYNE CO.: White Mills, *Adams* 4624 (PENN). WESTMORELAND CO.: Ligonier, *Matthews* 2399 (PAC). WYOMING CO.: Crane Swamp, *Stone* (PENN). YORK CO.: Dillsburg, *Hoover* 3073 (PAC).

Rhode Island: NEWPORT CO.: Tiverton, *Mearns* 211 (US). PROVIDENCE CO.: Pascoag, *Myers* 350 (WVA). WASHINGTON CO.: Kingston Hill, *Reynolds* 649 (HNH). **South Carolina:** ANDERSON CO.: Carpenter's Mill, *Davis* (MICH, MIN, UT). GREENVILLE CO.: Saluda River, *Freckman* 1239 (ISC). LEXINGTON CO.: Batesburg, *McGregor* 297 (US). MARLBORO CO.: Little Pee Dee River, *Radford* 12494 (TENN). OCONEE CO.: Whitewater, *Davis* 392 (MASS). PICKENS CO.: Table Rock, *Rodgers* 540 (DUKE). SPARTANBURG CO.: Campobello, *Erdman* 973 (BRY). SUMTER CO.: Poinsette St. Park, *Holdaway* (DUKE). **Tennessee:** ANDERSON CO.: Coal Creek, *Kearney* (MIN, OS, US). BLOUT CO.: Cades Cove, *Wallace & Jennison* 1621 (TENN). CAMPBELL CO.: Jellico, *Lamb & Williams* (TENN). CHEATHAM CO.: Marrowbone Creek, *De Selm* 1258 (TENN). CLAIBORNE CO.: Lone Mt. Ridge, *Kelley* 2459 (TENN). COFFEE CO.: Old Stone Fort, *Blum* 3732 (VDB). CUMBERLAND CO.: Ozone, *Demaree* 47496 (KY, NO, VDB). DAVIDSON CO.: Nashville, *Hubbard* 9112 (IND). DE KALB CO.: Smithville, *De Selme* 173 (TENN). DICKSON CO.: Sycamore School, *Jobe* (TENN). FENTRESS CO.: Clear Fork, *Sharp* 25648 (TENN). FRANKLIN CO.: Elk River, *Sharp & Adams* 10785 (TENN). GRAINGER CO.: Blaine, *Hodges* 20 (TENN). GREENE CO.: Horse Creek Rd., *Sherman & Sharp* 22280 (TENN). GRUNDY CO.: Mont Eagle, *Stiffler* (CU). HAMILTON CO.: Lookout Mt., *Scribner* (US). HARDIN CO.: *Kral* 36161 (VDB). HAWKINS CO.: Clinch Mt., *Wolfe* 19180 (TENN). HOUSTON CO.: Erin, *Palmer* 17610 (US). JOHNSON CO.: *Barclay* 12B (TENN). KNOX CO.: New Hopewell, *Sharp* 40454 (TENN). LAUDERDALE CO.: Summertown, *Postal* (IND). LAWRENCE CO.: Shoal Creek, *Sharp, Adams & Felix* 11058 (TENN). LEWIS CO.: Trace Creek, *Sharp, Adams & Felix* 10065 (TENN). MARION CO.: Fosters Falls, *Webb* 368 (TENN).

MONROE CO.: Skona River, *Galyon & Sharp* 21603 (TENN). MORGAN CO.: University Forest, *Shanks* 3141 (TENN). POLK CO.: Ocoee River, *Wilson* 3726 (TENN). PUTNAM CO.: Monterey, *Norris & Shanks* 2475 (TENN). RHEA CO.: Spring City, *James* (OS). ROANE CO.: Caney Creek, *Shanks* 22078 (TENN). ROBERTSON CO.: Pleasant View, *Shanks, Woods, & Cooley* 14776 (TENN). SEVIER CO.: Pittman Center, *Jennison* 3350 (TENN). UNICOI CO.: Rich Mt., *Price* 658 (DUKE). UNION CO.: Norris Lake, *Kelley* (TENN). VAN BUREN CO.: Spencer, *Shanks* 1288 (TENN). WASHINGTON CO.: Cherokee Mt., *Sharp* 3819 (TENN). WAYNE CO.: Butler Creek, *Shanks, Woods & Cooley* 9156 (TENN). WHITE CO.: Caney Fork, *Channell* 8956 (VDB). WILLIAMSON CO.: Ferndale, *Major* 6 (VDB). **Vermont:** BENNINGTON CO.: Pownal, *Eggleston* (HNH, US). **Virginia:** ALBEMARLE CO.: Miller School, *Tinsley* (NMC). AUGUSTA CO.: Stuarts Draft, *Churchill* (MSC). BLANO CO.: Suiter, *Kral* 10453 (VDB). CRAIG CO.: Newcastle, *Fogg, Jr.* 13211 (PENN). FAIRFAX CO.: Great Falls, *Bartlet* 1783 (IND). GILES CO.: Salt Pond Mt., *Fogg, Jr.* 12688 (PENN). GREENE CO.: Bear Fence Mt., *Fosberg* 17205 (PENN). ISLE OF WIGHT CO.: Smithfield, *Wise* (KY). JAMES CITY CO.: Gordon Creek, *Fernald & Long* 11393 (DUKE). KING GEORGE CO.: King George, *Muller* 3787 (ND). LOUDOUN CO.: Ashburn, *Pratt* (MU). MADISON CO.: Old Ray Mt., *Fosberg* 16909 (PENN). MONTGOMERY CO.: Blacksburg, *Musselman* 645 (UWM). NANSEMOND CO.: Nansemond River, *Fernald & Long* 13719 (US). NELSON CO.: *Hall* 3755 (VDB). NORFOLK CO.: Great Dismal Swamp, *Fernald & Long* 12147 (TENN). PITTSYLVANLA CO.: Smith Mt., *Zobel* (DUKE). ROANOKE CO.: Sugarloaf Mt., *Ebinger* 4041 (MU). ROCKBRIDGE CO.: G. Washington Nat'l. Forest, *Hall* 3716 (VDB). ROCKINGHAM CO.: Shenandow Forest, *Eggleston* 18624 (US). RUSSELL CO.: Clinch Mt., *Kral* 23850 (VDB). SMYTH CO.: Pond Mt., *Small* (MSC, US). WISE CO.: Norton, *Pennell* 11813 (ISC). **West Virginia:** BARBOUR CO.: Nestorville, *Core* 5922 (WVA). BERKELEY CO.: Back Creek, *Core* 5847 (WVA). BRAXTON CO.: Little Birch, *Harris* (WVA). CALHOUN CO.: Pink, *Harris* (WVA). CLAY CO.: Clay, *Core* 6372 (WVA). DODDRIDGE CO.: West Union, *Bartholomew* (WVA). GRANT CO.: Dolly Sods Mt., *Davis & Davis* 7129 (WS). GREENBRIER CO.: Muddy Creek Mt., *Fox* (WVA). HAMPSHIRE CO.: Ice Mt., *Frye* 1269 (WVA). HARDY CO.: North Mt., *Core & Ludwig* 399 (WVA). HARRISON CO.: Duck Creek, *Martin* 327 (WVA). JEFFERSON CO.: Charlestown, *Harper* (CU). KANAWHA CO.: Nitro, *Greenlee* (WVA). MCDOWELL CO.: Panther, *Music* (WVA). MARION CO.: Pinesville, *Bodola* (WVA). MARSHALL CO.: Calis, *Bartholomew* 1941-217 (WVA). MERCER CO.: Pinnacle Rock, *Fox* (WVA). MINERAL CO.: Patterson Creek, *Brown* (WVA). MINGO CO.: Chattaroy, *Bowen* (WVA). MONONGALIA CO.: Cassville, *Watkins* (WVA). MONROE CO.: Wayside, *Fox* (WVA). MORGAN CO.: Langent, *Core* 5739 (WVA). NICHOLAS CO.: Calvin, *Creasy* (WVA). PENDLETON CO: Seneca Rocks, *Clarkson* 2001

(WVA). POCAHONTAS CO.: Droop Mt., *Ludwig* 77 (WVA). PRESTON CO.: Pisqah Rd., *Meyer* 247 (HNH, PENN, TENN, WVA). RANDOLPH CO.: Roaring Plains, *Core* 3171 (WVA). RITCHIE CO.: Cairo, *Goodwin* 251 (WVA). SUMMERS CO.: Barger Springs, *Boone* (WVA). TAYLOR CO.: Wickwire Run, *Core* 5475 (WVA). TUCKER CO.: Blackbird Knob, *Gibson* 1039 (WVA). UPSHUR CO.: Bucklin, *Pollock* (MIN, US). WAYNE CO.: Hurricane Creek, *Lycan* 59 (WVA). WEBSTER CO.: Camp Caesar, *Fox* (WVA). WETZEL CO.: Smithfield, *Wagner* (WVA). WIRT CO.: Standingstone Creek, *Bartholomew* W-5007 (WVA).

Mountain laurel commonly forms dense thickets in rocky and sandy forests throughout most of its range, particularly where there are openings in the canopy. It is also found in pastures and open fields and commonly forms thickets at the edge of roads. A detailed map of the known range of *Kalmia latifolia* is given by Kurmes (1967) who considers the report of this species from Ontario and New Brunswick to be an error, as is the report from the valley of the Red River in Arkansas (Britton, 1908). The report of this species from Canada probably originates from Pursh (1814), and it has been perpetuated by Brunet (1867), Sargent (1893), and more recently by Munns (1938). There is no evidence that this species is native to any part of Canada. It is possible that these early reports were based on cultivated plants or large-leaved specimens of *K. augustifolia* (Macoun, 1884). Presently the species is known from southern and southeastern Maine (Fernald, 1911; Lamson-Scribner, 1891; Norton, 1913, 1935; and Perkins, 1935), southern New Hampshire (Hodgdon, 1955) and southern Vermont (Deane, 1899).

The ecological requirements of *Kalmia latifolia* in the deciduous forests of eastern United States have been examined by a few authors. Kurmes (1961) studied the ecology of mountain laurel in southern New England and determined its exact range from herbarium material and field observations. The relationship of this species to water run-off and the water-holding capacity of the soil was studied by Colvin and Eisenmenger (1943) and Johnson and Kovner (1956). Studies have also been made of the rate of water-vapor loss from its leaves (Meyer, 1927), the seasonal variation in the moisture content of its leaves (Reifsnyder, 1961) and seasonal changes in cold resistance (Parker, 1961). The competition of mountain laurel with tree seedlings and sprouts has also been studied. Wahlenberg and Doolittle (1950) found that under normal conditions in the southern Appalachian mountains *K. latifolia* forms dense thickets that preclude any natural regeneration of timber trees. Their studies indicate that partial clearing of these thickets followed by planting of desirable tree species is an effective method of forest regeneration. They also found that mountain laurel has a mean annual height growth of 0.4 feet and a lateral growth of 0.3 feet.

Kalmia latifolia is usually a tall, spreading shrub that throughout most of its range rarely exceeds a height of 12 feet. In the fertile valleys between the Blue Ridge and the Alleghany Mountains, however, this species may attain the size of a small tree. Engelmann, Canby, and Gray (1877) observed a number of large individuals growing in the bottom of a dell, back of Caesar's Head, on the extreme western border of South Carolina. One of the trunks measured 4 feet 1¼ inches in circumference about 1 foot above the ground while another in the same area was 3 feet 4 inches above the first fork, and at 1 foot above the ground was 4 feet 4 inches in circumference. Later, Sargent (1893) records its maximum size as 30-40 feet tall with a diameter of 18-20 inches. The largest specimen on record, as listed by the American Forestry Association (1955), is a plant from the Great Smoky Mountains National Park with a circumference of 3 feet 6 inches, a height of 25 feet, and a spread of 45 feet. This specimen is probably located at Forney Ridge, Swain County, Tennessee (*Barksdale & Jennison* 1285).

Besides the numerous studies concerned with the poisonous properties of mountain laurel, some early attempts were undertaken to determine what other substances were present. These early studies reported the presence of arbutin, gums, and tannins (Kennedy, 1875), bark tannins (DeGraffe, 1896) and fat deposits (Stanley, 1931). More recently the effects of herbicides on *Kalmia latifolia* have been studied. Egler (1947, 1948) found that 2,4-D has no permanent effect, causing only temporary stunting and curvature of the foliage. Later, Egler (1949, 1950) found that a weak solution (.25%) of a 2,4-D and 2,4,5-T combination causes temporary cessation of growth, but a strong solution (5%) is necessary to ensure death.

The synonomy of mountain laurel is not very extensive. Most of the names proposed are for forms and varieties which are the result of the extreme variation that exists in flower color, leaf shape and size, plant size and pubescence. In 1940, Fernald described a variety (*laevipes*) of *Kalmia latifolia* from the coastal plain on southeastern United States. He considered this variety in its extreme development as having pedicels that are "quite smooth or with the merest suggestion of sessile glandular spots". In typical *K. latifolia,* in contrast, the pedicels are densely floccose and viscid with stalked glandular hairs. Many individuals with few or no glands on the pedicels are found in Indiana and Ohio, as well as on the coastal plain from Virginia to Louisiana. In some populations specimens with both glandless and glandular pedicels are found. Also, Radford, Ahles, and Bell (1968) mention that this condition is very variable, with a tendency for pedicels to be floccose on plants in the mountains and less glandular on the coastal plain. Because of this variation it appears best to consider these individuals as an extreme that occurs in the southern and western parts of the range of *K. latifolia.*

A total of 7 forms of *Kalmia latifolia* have been recognized by Rehder (1910, 1945, 1949). Many of these were originally described as varieties, but that classification is not appropriate for these taxa in either the horticultural or botanical sense. It is possible that these taxa could be treated as cultivars as done by Holmes (1956) and Dudley (1967), but most are better treated as forms as defined by Davis and Heywood (1963). The genetic evidence indicates that most of these taxa are not unique clones, but rather are sporadic variants distinguished by a single or a few linked characters, without a distinct distribution. Also, they do not represent the normal extremes of most populations, but are the result of the repeated association of recessive genes that are of a limited occurrence in some populations. Of the 7 forms recognized by Rehder, 5 fit the criteria of a form as described above. The remainder, both variations in flower color (alba and rubra), unlike the forms, are not aberrant or disjunct, but are connected to the typical light pink flower by intermediate color types.

Kalmia latifolia f. **angustata** Rehd. Jour. Arnold Arb. **26:** 481. 1945. TYPE: **New Jersey:** CAPE MAY CO.: Dennis township, *H. A. Scribner* (GH).

Kalmia latifolia β. salicifolia Forbes, Hort. Woburn. 93. 1833. (nom. nud.).

This very rare foliage form has narrowly oblanceolate to linear leaves that are 4-8 cm long and 4-10 mm wide. Living material of the type is cultivated at the Arnold Arboretum (Rehder, 1945). The only specimens of f. *angustata* seen by the author are cultivated plants.

Common name: Willow-leaved Mountain Laurel.

Kalmia latifolia f. **fuscata** (Rehd.) Rehd. Rhodora **12:** 2. 1910.

Kalmia latifolia var. *fuscata* Rehd. Möller's Deutsch. Gart. Zeit. **18:** 578. 1903. TYPE: **New York:** Canaan Four Corners, *Dr. Childs* (GH).

Kalmia latifolia var. *coronata* Gray, Amer. Nat. **2:** 324. 1868. TYPE: **Massachusetts:** woods near Framingham, *James Parker* (GH).

Kalmia latifolia var. *maculata* Raf. Medical Flora **2:** 17. 1830. TYPE: unknown.

This form is distinguished by white to pink flowers that have a heavily pigmented, usually continuous, brownish-purple or cinnamon band on the inside of the corolla at the level of the anther pockets. This band breaks up into brownish dots toward the base and the margin of the corolla. It also shows through to the outside of the bud giving it a muddy appearance.

Some variation does exist in the size, shape and color of the band with an interrupted band existing in some of the specimens examined. According to Jaynes (personal communication) controlled crosses with specimens showing this banded characteristic strongly suggests that the character is determined by a single dominant gene.

Common name: Banded Mountain Laurel, Crowned Mountain Laurel.

SPECIMENS EXAMINED

Alabama: near Citronella, *Milligan* (US). **Connecticut:** near Chaplin, *Jaynes* (EIU). **Massachusetts:** near Framingham, *Parker* (GH); Wales, *Clark* (MASS); *Guterman* (MASS). **New York:** Brewster, *Jaynes* 240 (EIU). **North Carolina:** Highlands, *Anderson* (US). **Ohio:** Holden Arboretum, Mentor, *Jaynes* 94 (EIU). **Pennsylvania:** nursery in Stroudsburg, *Jaynes* 168 (EIU).

Kalmia latifolia f. **myrtifolia** (Bosse) K. Koch, Dendrologie 2(1): 153. 1872.

Kalmia latifolia var. *myrtifolia* Bosse, Vollst. Handb. Blumengart. 2: 348. 1841. *Kalmia myrtifolia* Andre, Revue Hort. 55: 10. 1883. TYPE: unknown, probably a living plant.

Kalmia latifolia f. *minor* K. Koch, Dendrologie 2(1): 153. 1872. TYPE: unknown, probably a living plant.

Kalmia latifolia var. *nana* Lavallée, Arbor. Segrez. 159. 1877. (nom. nud.); Mouillefert, Traité Arb. Arbrisse 2: 1027. 1897. TYPE: unknown, probably a living plant.

This form is in all respects a miniature mountain laurel, being compact and slow-growing, rarely exceeding a height of 3 feet. In all specimens examined the leaves are much smaller than in typical *Kalmia latifolia*, averaging 2-4 cm long and about 1 cm wide. Also, flower size and length of the internodes are approximately 1/3 to 1/2 normal. Recent evidence (Jaynes, personal communication) suggests that this dwarf condition is controlled by a single recessive gene.

According to Dudley (1967) this form has been grown since 1840 and is occasionally found in gardens where space is limited. Though occasionally mentioned in the early horticulture literature of Europe, the first reference to this form in North American literature appears to be by

Sprague (1871). The only report of wild plants of f. *myrtifolia* appeared in 1895 (Anonymus) which, according to the author, were identical to the cultivated dwarf form.

Common name: Miniature Mountain Laurel, Dwarf Mountain Laurel.

SPECIMENS EXAMINED

Connecticut: Portland, *Jaynes* 25 (EIU). **Massachusetts:** Arnold Arboretum, *Hornby* (MASS).

Kalmia latifolia f. **obtusata** (Rehd.) Rehd. Rhodora **12:** 2. 1910.

Kalmia latifolia var. *obtusata* Rehd. Möller's Deutsch. Gart. Zeit. **18:** 577. 1903. TYPE: **Connecticut:** near Pomfret, *Bowditch.*

Kalmia latifolia var. *ovatifolia* Raf. Medical Flora **2:** 17. 1830. (nom. nud.).

This foliage form has leaves that are oval to oblong-obovate and rounded at both ends. In the specimens examined the leaves average 4-7 cm long and 2.5-4 cm broad, are apiculate, and have short petioles that rarely exceed 1 cm in length. According to Rehder (1910) this form is slow growing, forms a compact bush, and has been cultivated at the Arnold Arboretum since 1886 when it was propagated from the type plant. Dudley (1967) suggested that the cultivar 'Ovata' which is available from some European sources is a synonym of this variant.

Common name: Hedge Mountain Laurel.

SPECIMENS EXAMINED

Connecticut: Riverton, *Jaynes* 291 (EIU). **Massachusetts:** 1 mi. east of Ashby, *Ahles* 65135 (MASS); Arnold Arboretum, *Wyman* 2854 (MSC), *Jaynes* 238 (EIU).

Kalmia latifolia f. **polypetala** (Nickolson) Beissner, Schelle, & Zabel, Handb. Laubholz-Benennung 386. 1903.

Kalmia latifolia var. *polypetala* Nicholson, Hand-list Trees Shrubs Arb. **2:** 49. 1896. *Kalmia latifolia* f. *polypetala* (Nicholson) Rehd. Rhodora **12:** 1. 1910. TYPE: **Massachusetts:** near South Deerfield, *Miss M. Bryant* (GH).

Kalmia latifolia var. *monstruosa* Mouillefert, Traité Arb.

Arbrisse **2**: 1027. 1897. TYPE: Unknown, probably a living plant.

This form has the corolla deeply divided into 5 narrow to fairly broad, strap-shaped petals. In some specimens these petals are extremely narrow and thread-like due to the revolution of the margins. Gray (1871) reports that these narrow petals resemble filaments and are sometimes tipped with imperfect anthers. More commonly the petals are broader, and a few specimens have been found in which the individual flowers appear much like apple blossoms. Other variations include an apetalous type which has been observed in some nursery stock from Massachusetts, and a cultivar named 'Bettina' (Dudley, 1967) in which the corolla is deeply lobed. According to Jaynes (personal communication) the inheritance data fits the hypothesis that the genetic control of the polypetalous condition is by a single recessive gene.

This form was first described by Gray (1871) and later by Sargent (1890), while Bean (1897) mentioned that this unusual form flowers each year at the Kew Gardens. It was given the name var. *polypetala* by Nicholson (1896) and the name var. *monstruosa* by Mouillefert (1897), both based on Sargent's description of 1890. This taxon was first considered as a form by Beissner, Schelle, and Zabel (1903) who use the name *polypetala* and cite Sargent as the author.

This form appears to occur most commonly in Massachusetts. Stone (1909) reported it growing at the edge of a road in Leverett, not far from Mt. Toby, while Britton (1925) reports that Dr. Stone has found it from three different stations, all on or near Mt. Toby. Mt. Toby is close to South Deerfield, the type locality of this form.

Common name: Feather Petal Mountain Laurel.

SPECIMENS EXAMINED

Massachusetts: Arnold Arboretum, *Wyman* 2458 (MSC); Leverett, Mt. Toby, *Henry* (MASS), *Osmun* (MASS), *Stone* (MASS), 67570 (MASS). **North Carolina:** Danbury, Hanging Rock State Park, *Rogers* (EIU).

4. **Kalmia angustifolia** Linnaeus, Sp. Pl. 1: 391. 1753.
TYPE: "Habitat in Pensylvania, Nova Caesarea, Noveboraco" (LINN 560.2, lectotype, specimen on the right).
Chamaedaphne angustifolia (L.) Kuntze, Rev. Gen. Pl. 2: 388. 1891.

Much branched shrub to 1.5 m tall; branchlets terete, reddish-brown, glabrous to pubescent and stipitate-glandular, usually ascending; leaves in whorls of 3 (rarely a few alternate or opposite), slightly coriaceous, evergreen, flat, oblong to elliptic-lanceolate, 2-5 (rarely 7) cm long, 0.5-2 cm wide, usually lightly puberulent above with short white hairs, sometimes glabrate with age, midrib puberulent above, glabrous to puberulent beneath, sometimes stipitate-glandular; petioles to 1 (rarely 1.5) cm long, usually puberulent; inflorescence of numerous corymbiform racemes from the axils of last year's leaves; pedicels 0.5-2 cm long, puberulent and stipitate-glandular, subtended by 2 bracteoles in the axil of a lanceolate bract, 1-6 mm long; main axis of the inflorescence less than 1.5 cm long; calyx puberulent outside, glabrous within, usually green, sometimes the tip reddish, or reddish throughout, 3-6 mm broad, the lobes usually acuminate; corolla reddish-purple to pink (rarely white), puberulent outside, puberulent toward the base within, 6-13 mm broad; anthers purplish-brown, .5-1 mm long; filaments puberulent on the lower half; capsule depressed globose, 3-5 mm broad, 2-3.5 mm long, puberulent and stipitate-glandular; seed stramineous, 0.6-1 mm long, and testa loose and extending past the ends of the seed. Chromosome number $n = 12$.

Kalmia angustifolia is a common species in eastern North America. It is found from northern Ontario, Quebec and Labrador, through the Great Lakes region, and south along the east coast of the United States to the Carolinas. It is primarily a plant of bogs and other wet, open areas, but is also found in open woods and as a weed in open areas, sometimes forming dense thickets.

Genetically this species is most closely related to *Kalmia latifolia*. When *K. angustifolia* is the male parent the cross is not successful because the sheep laurel pollen will not grow down the style of mountain laurel (Jaynes, 1968a). The reciprocal cross, however, resulted in about 18% of the flowers producing capsules which contained some viable seed. These resulting interspecific hybrids were intermediate to the parental types, although leaf arrangement was primarily alternate, as in *K. latifolia.* Jaynes (1968a) also reported that *K. angustifolia* could be crossed with both *K. hirsuta* and *K. polifolia.* Both crosses produced mostly weak, yellow-green individuals that died within the year. A few individuals lived longer, and some produced flowers with sterile pollen.

Small (1903, 1914) considered this taxon as two separate species, a procedure not followed by subsequent authors. Both Fernald (1950) and Gleason (1952) considered this complex as being one species with two fairly distinct varieties, a view that has recently been followed by Radford, Ahles, and Bell (1968). Considering the genetic and morphological similarities of these taxa it is more realistic to follow the latter view and consider it as a single species with two fairly distinct varieties.

KEY TO VARIETIES

1. Calyx densely stipitate-glandular; mature leaves not puberulent beneath. . . . . 4a. var. *angustifolia.*
1. Calyx lacking stipitate-glands, or nearly so; mature leaves densely puberulent beneath. . 4b. var. *caroliniana.*

4a. **Kalmia angustifolia** L. var. **angustifolia.**

Kalmia angustifolia β carnea Ait. Hort. Kew. **2**: 64. 1789.

Kalmia angustifolia var. *hirsuta* Jäger, Ziergeholze 278. 1865. *Kalmia angustifolia* f. *hirsuta* Voss, Blumengart. **1**: 591. 1894. (without basonym).

Kalmia angustifolia var. *lucida* Lavalée, Arbor. Segrez. 159. 1877. (nom. nud.). *Kalmia angustifolia* f. *lucida* Beissner, Schelle, & Zabel, Handb. Laubholz-Benennung 386. 1903. (nom. nud.).

Kalmia angustifolia var. *minima* Bosse, Vollst. Handb. Blumengart. 2: 347. 1841.

Kalmia angustifolia var. *nana* Bosse, Vollst. Handb. Blumengart. 2: 347. 1841. *Kalmia angustifolia* f. *nana* Voss, Blumengart. 1: 591. 1894. (as snyonym).

Kalmia angustifolia β *ovata* Pursh, Fl. Amer. Sept. 296. 1814.

Kalmia angustifolia f. *procumbens* Beissner, Schelle, & Zabel, Handb. Laubholz-Benennung 386. 1903. (nom. nud.).

Kalmia angustifolia var. *rosea* Forbes, Hort. Woburn. 93. 1833. *Kalmia angustifolia* f. *rosea* Beissner, Schelle, & Zabel. Handb. Laubholz-Benennung 386. 1903. (nom. nud.).

Kalmia angustifolia var. *variegata* Forbes, Hort. Woburn. 93. 1833.

Kalmia elliptica Raf. Autikon Bot. 87. 1840. (as synonym).

Kalmia ferruginea Raf. Autikon Bot. 86. 1840. TYPE: unknown.

Kalmia media K. Koch, Dendrologie II; 1: 153. 1872. *Kalmia angustifolia* f. *media* Beissner, Schelle, & Zabel, Handb. Laudholz-Benennung 386. 1903. (nom. nud.) TYPE: unknown.

Kalmia intermedia Lange Ind. Sem. Hort. Hauniensi Nom. emendata 3. 1873. *Kalmia glauca* β *intermedia* Lange Ind. Sem. Hort. Hauniensi Nom. emendata 3. 1873. (as synonym). TYPE: a herbarium specimen in the Botanical Museum of Copenhagen (C) labeled *Kalmia intermedia* Lge ad int. Hort. bot. Haun. 16. Juni 1873, sem. ex hort. Paris s.n.

Kalmia angustifolia β *oleifolia* Pers. Syn. Pl. 1: 477. 1805. *Kalmia oleifolia* (Pers.) Bosse, Vollst. Handb. Blumengart. 2: 347. 1841. (as synonym). TYPE: unknown.

Kalmia angustifolia var. *pumila* Forbes, Hort. Woburn. 93. 1833. *Kalmia pumila* Bosse, Vollst. Handb. Blumengart. 2: 347. 1841. (as synonym).

Kalmia pumila rubra Bosse, Vollst. Handb. Blumengart. 2: 347. 1841. (as synonym).

Kalmia pumila serotina Bosse, Vollst. Handb. Blumengart. 2: 347. 1841. (as synonym). *Kalmia angustifolia* f. *pumila* Voss, Blumengart. 1: 591. 1894. (without basonym). TYPE: unknown.

Kalmia angustifolia α *rubra* Ait. Hort. Kew 2: 64. 1789. *Kalmia angustifolia* var. *rubra* (Ait.) Loddiges, Bot. Cab. 6: 502. 1821. *Kalmia rubra* (Loddiges) Bosse, Vollst. Handb. Blumengart. 2: 347. 1841. (as synonym). *Kalmia angustifolia* f. *rubra* Voss, Blumengart. 1: 591. 1894. (without basonym). TYPE: unknown.

Kalmia angustifolia var. *serotina* Bosse, Vollst. Handb. Blumengart. 2: 347. 1841. *Kalmia serotina* Bosse, Vollst. Handb. Blumengart. 2: 347. 1841. (as synonym). TYPE: unknown.

Mature leaves glabrous or with scattered stalked glandular hairs beneath, usually not puberulent; calyx puberulent and strongly stipitate-glandular; corolla glabrous or lightly puberulent on the outside.

Distribution: Bogs, swamps, and other wet open areas from Ontario east to the Atlantic Ocean and southeast through the Great Lakes to Pennsylvania and south along the coast to Virginia.

Common name: Sheep Laurel, Lambkill, Sheepkill, Wicky, Narrow-leaved Kalmia, Dwarf Laurel, Pig Laurel.

REPRESENTATIVE SPECIMENS

UNITED STATES: **Connecticut:** FAIRFIELD CO.: Trumbull, *Eames* 2809 (CONN). HARTFORD CO.: Kensington, *Cowles* (MU). LITCHFIELD CO.: Salisbury, *Ebinger* 697 (MU). NEW HAVEN CO.: New Haven, *Safford* 163 (US). NEW LONDON CO.: Groton, *Jausson* (CONN, UT). TOLLAND CO.: Donovans Bog, *Travis* 1959 (PENN). WINDHAM CO.: Hasting's Woods, *Petersen* (VDB). **Delaware:** NEW CASTLE CO.: Hogswamp Road, *Tatnall* 4858 (GH). SUSSEX CO.: *Canby* (US). **Maine:** ANDROSCOGGIN CO.: Lewiston, *Bean* 14793 (VDB). AROOSTOOK CO.: Knoles Corner, *Neal* 1907 (MAINE). CUMBERLAND CO.: Cape Elizabeth, *Gayle* 766 (US). HANCOCK CO.: Bar Harbor, *Rossbach* 2757 (ACAD, NCU). KENNEBEC CO.: Clinton, *Bean* (MAINE). KNOX CO.:

Glencove, *Friesner* 7721 (MU, RENO, UT, WS, WVA). LINCOLN CO.: Ocean Point, *Fassett* 3946 (DUKE). OXFORD CO.: White Mt. Nat'l. Forest, *Richards* 6066 (MAINE). PENOBSCOT CO.: Old Town, *Davis* (MAINE). PISCATAQUIS CO.: Sangerville, *Fernald* 127 (MIN). SAGADAHOC CO.: Five Islands, *Rehder* 1018 (GH). SOMERSET CO.: Baker Brook, *St. John & Nichols* 2431 (CAN, NY). WALDO CO.: Searsmont, *Rossbach* 1932 (ACAD, MAINE). WASHINGTON CO.: Joe Dyer's Point, *Walker* 3039 (MAINE). YORK CO.: Sand Pond, *Richards* 5951 (MAINE). **Maryland:** ANNE ARUNDEL CO.: Severn Run, *Adams & Wherry* 3200 (GH). CECIL CO.: North East, *Long* 54422 (GH). CHARLES CO.: Waldorf, *Nieuwland* (ND). PRINCE GEORGES CO.: Airport Bog, *Herman* 11546 (NY). WICOMICO CO.: Sharptown, *Tidestrom* 12229 (GH). WORCESTER CO.: Furnace, *Redmond* 237 (MICH). **Massachusetts:** BARNSTABLE CO.: Falmouth, *Greenman* 3043 (MIN). BERKSHIRE CO.: Great Barrington, *Eggleston* 21413 (MIN, NY). ESSEX CO.: Marblehead, *Nelson* 341 (CAN). FRANKLIN CO.: Mt. Toby, *Seymour* 2566 (DUKE, MASS). HAMPDEN CO.: Granville, *Seymour* 137 (MASS, MIN, NY). HAMPSHIRE CO.: Amherst, *Torrey* (MASS). MIDDLESEX CO.: Townsend, *Ahles* 65188 (MASS). NANTUCKET CO.: Polpis, *Mackeever* 504 (PENN). NORFOLK CO.: Medfield, *Batchelder* 234 (NCU). PLYMOUTH CO.: Ellisville, *Erdman* 4223 (BRY). WORCESTER CO.: Mount Wachusett, *Palmer* 43196 (MIN). **Michigan:** ALCONA CO.: Lincoln, *Voss* 4583 (MICH). ALPENA CO.: Alpena, *McVaugh* 11405 (MICH). ARENAC CO.: Omer, *Voss* 6794 (MICH). CHARLEVOIX CO.: Garden Isl., *Cain* 149 (TRT). CHEBOYGAN CO.: Wolverine, *Gleason & Gleason, Jr.* 248 (GH, IND, ISC, NY, WVA). CRAWFORD CO.: Grayling, *Voss* 3098 (MICH). IOSCO CO.: Sand Lake, *Dreisbach* 7243 (CONN). KALKASKA CO.: *Zavitz* 1168 (QUK). MISSAUKEE CO.: Moorestown, *Voss* 3087 (MICH, OS). MONTMORENCY CO.: *Hagenah* 4936 (BLH). OSCODA CO.: Rhodes Lake, *Voss* 3578 (MICH). OTSEGO CO.: Hardwood Lake, *McVaugh* 10888 (BLH, CAN, MICH, MO). PRESQUE ISLE CO.: Emma, *Clover* 26193 (MICH). ROSCOMMON CO.: Roscommon, *Voss* 4258 (MICH). SAGINAW CO.: Sage Lake, *Case, Jr.* (MICH). **New Hampshire:** BELKNAP CO.: Crystal Lake, *Hodgdon & Steele* 9124 (NHA). CARROLL CO.: Albany, *Gale* (NHA). CHESHIRE CO.: Winchester *Manning* (BRY). COOS CO.: Randolph, *Pease* 4696 (GH, MICH). GRAFTON CO.: Pike, *Mathias* 163 (MIN). HILLSBORO CO.: Mt. Monadnock, *Andrews* 895 (ORE). MERRIMACK CO.: Wilmot, *Hodgdon & Steele* 9949 (NHA). ROCKINGHAM CO.: *Harris* 224 (NHA). STRAFFORD CO.: Rochester, *Barrett & Hodgdon* 15522 (NHA). SULLIVAN CO.: Springfield, *Hodgdon & Steele* 9129 (NHA). **New Jersey:** ATLANTIC CO.: Hammonton, *Keefe* 123 (UWM). BERGEN CO.: Carlstadt, *Niederer* (NY). BURLINGTON CO.: Rancocas River, *Leonard* 6314 (US). CAMDEN CO.: Atco, *Painter* 684 (MIN, US). CAPE MAY CO.: Belleplain, *Fender* 4916 (PAC, PENN). CUMBERLAND CO.: Millville, *Adams* 324 (GH, PENN). ESSEX CO.: Franklin, *Rusby* (CHRB).

GLOUCESTER CO.: Repaupo, *Long* 16065 (GH). MIDDLESEX CO.: Milltown, *House* (US). MONMOUTH CO.: Farmingdale, *Long & Brown* 3557 (PENN). MORRIS CO.: Mt. Hope, *Britton* (CHRB). OCEAN CO.: Lakewood, *Mackenzie* 3112 (US). PASSAIC CO.: Uttertown Bog, *Montgomery* (CHRB). SALEM CO.: Auburn, *Fogg, Jr.* 6616 (PENN). SOMERSET CO.: Sourland Mts., *Fogg, Jr.* 12406 (PENN). SUSSEX CO.: Cranberry Lake, *Mackenzie* 717 (ARIZ, IND).

New York: ALBANY CO.: Karmer, *House* 7850 (CAN). CHENANGO CO.: Plymouth Pond, *Wiegand* 6976 (GH). CLINTON CO.: *Rudd* 816 (US). COLUMBIA CO.: Ghent, *McVaugh* 362 (PENN). DUTCHESS CO.: Susan Court, *Ahles* 64464 (MASS). ESSEX CO.: Lake Harris, *House* 8072 (CAN). FRANKLIN CO.: Upper Saranac Lake, *Muenscher, et. al.* 476 (NY). FULTON CO.: Gloversville, *Haught* (WVA). GREENE CO.: *Coville* (GH). HAMILTON CO.: Little Tupper Lake, *Fosberg* 16101 (PENN). JEFFERSON CO.: Perch Lake, *Beschel* 17144 (QUK). LEWIS CO.: Martinsburg, *Hotchkiss* 2654 (GH). NASSAU CO.: Massapequa St. Park, *Cain* 93 (MO, PENN, TENN). ONEIDA CO.: Sylvan Beach, *Maxon* (US). ORANGE CO.: Sutherland Pond, *Mearns* 125 (US). RENSSELAER CO.: West Sand Lake, *Brown* 652 (DUKE). RICHMOND CO.: Staten Isl., *Dowell & Davis* 2224 (GH). ST. LAWRENCE CO.: Norfolk, *Phelps* 756 (GH, NY, US). SARATOGA CO.: Corinth, *Whitney* 4124 (PENN). SUFFOLK CO.: South Haven, *Moldenke* 18685 (NY). SULLIVAN CO.: Wurtshore, *Hess* 1267 (ARIZ). ULSTER CO.: Highland, *Chrysler* (CHRB). WARREN CO.: Luzerne, *Fogg, Jr.* 20309 (PENN). WASHINGTON CO.: Lake Nebo, *Burnham* 2756 (MIN). **Pennsylvania:** BERKS CO.: Hamburg, *Berkheimer* 1734 (PENN). BRADFORD CO.: Troy, *Beardslee* (MU). BUCKS CO.: Bristol, *Adams* 4514 (MAINE, PENN). CARBON CO.: Little Gap, *Adams* 3331 (GH, ISC, PENN). CHESTER CO.: Warwick, *Wherry* (GH). COLUMBIA CO.: Centralia, *Fogg, Jr.* 14256 (NY, PENN). CUMBERLAND CO.: Sand Springs, *Ward* (PAC). DELAWARE CO.: Tinicum, *Baker* (PENN). FRANKLIN CO.: Caledonia St. Park, *Overhots* (PAC). LACKAWANNA CO.: West Mt., *Glowenke* 6528 (MIN, NY). LANCASTER CO.: Smithville, *Small* (US). LEHIGH CO.: Allentown, *Dowell* 1115 (US). LUZERNE CO.: Freeland, *Orton* (PAC). LYCOMING CO.: Bald Eagle Mt., *Keener* 2561 (PAC). MONROE CO.: Tannersville, *Swartley* 791 (MAINE). NORTHAMPTON CO.: Danielsville, *Schaeffer, Jr.* 6184 (PAC). NORTHUMBERLAND CO.: Montandon, *Reed* 235 (CHRB). PIKE CO.: Twin Lakes, *De Pue* 878 (PENN). SCHUYLKILL CO.: Tamaqua, *Kriebel* 8586 (ND). SOMERSET CO.: Salisbury, *Caffrey* (PAC). SULLIVAN CO.: Double Run, *Fogg, Jr.* 14437 (PENN). WAYNE CO.: Big Spring Pond, *Glowenke* 2434 (PENN). WYOMING CO.: Falls, *Glowenke* 2023 (PENN). YORK CO.: McCall's Ferry, *Heller & Halbach* (MIN). **Rhode Island:** KENT CO.: Warwick, *Congdon* (OS). NEWPORT CO.: Newport, *Mearns* 254 (GH). PROVIDENCE CO.: Slaterville, *Palmer* 43348 (ISC, MIN). WASHINGTON CO.: South Kingstown, *Collins* (CONN). **Vermont:** ADDISON CO.:

Bristol Pond, *Eggleston* 21453 (US). BENNINGTON CO.: Manchester, *Day* 267 (GH). CALEDONIA CO.: Barnet, *Blanchard* (HNH, MO). CHITTENDEN CO.: S. Burlington Twp., *Charette* 2190 (BRY, MIN). FRANKLIN CO.: East Berkshire, *Clausen* (MO, US). ORANGE CO.: Fairlee, *Grover* (MU). RUTLAND CO.: Middletown Springs, *Carpenter* (NCU). WASHINGTON CO.: Roxbury, *Countryman* 820 (HNH, NHA). WINDHAM CO.: Westminster, *Robinson* 30 (GH). WINDSOR CO.: Reading, *Kittredge* (NY). **Virginia:** ISLE OF WIGHT CO.: Franklin, *Heller* 1124 (GH, MIN, MO, PENN, US, WS); Lee's Mill, *Fernald & Long* 12146 (GH, MO, NY, US), *Harvill* 15946 (NCU); Zuni, *Fernald, Griscom & Long* 6665 (GH, NY), 6666 (GH, PENN). NANSEMOND CO.: Cherry Grove, *Fernald & Long* 11392 (DUKE, GH, US); County Rd. 665, *Duke* 1067 (NCU); South Quay, *Fernald & Long* 10366 (GH, NY).

CANADA: **Labrador:** Assizes Isl., *Potter & Brierly* 3424 (GH); Cape St. Charles, *Potter & Brierly* 3427 (GH); Cartwright, *Brown* (GH); Forteau, *Long* 28832 (GH); Goose Bay, *Gillett & Findley* 5352 (MIN, MO, TRT, WS), 5584 (ACAD, NY, US); Kenamu River, *Gillett & McKay* 5831 (ACAD, GH); St. Clary's River, *Wallace* 23 (CONN). **New Brunswick:** ALBERTA CO.: Grindstone Isl., *Christie* 1575 (NBM). CARLETON CO.: East Wolf Isl., *Hodgdon & Pike* (NCU). CHARLOTTE CO.: Deer Isl., *Squires & Squires* (NBM). GLOUCESTER CO.: Four Roads, *Roberts & Pugh* 65-4358 (CAN). KENT CO.: Richibucto, *Scoggan* 12135 (CAN). KINGS CO.: Havelock, *Perry* (ACAD). MADAWASKA CO.: St. Leonard, *Malte* 294 (CAN). NORTHUMBERLAND CO.: Mt. Carleton, *Smith & Clattenburg* 20066 (ACAD, QUK). QUEENS CO.: Mill Brook, *Squires & Christie* (NBM). RESTIGOUCHE CO.: Dalhousie, *Scoggan* 11721 (ACAD, CAN). ST. JOHN CO.: Mispec, *Crawford & Patterson* (ACAD). SUNBURY CO.: Mill Settlement, *Christie* 245 (NBM). WESTMORLAND CO.: Johnson Lake, *Beschel* 5508 (QUK). **Newfoundland:** BONAVISTA NORTH DIST.: Glovertown, *Smith, Squires, & Smith* 116 (ACAD), 135 (ACAD). BONAVISTA SOUTH DIST.: Lethbridge, *Rouleau* 8370 (NFLD). BURGEO-LA POILE DIST.: Osmond, *Rouleau* 7375 (NFLD, US). CARBONEAR DIST.: Old Perlican, *Torrey* 25 (CAN, GH). FERRYLAND DIST.: Witless Bay, *Rouleau* 5364 (NFLD). FOGO DIST.: Stag Harbour, *Ludlow* 125 (ACAD). FORTUNE BAY-HERMITAGE DIST.: Wallace Cove, *Rouleau* 8089 (NFLD). GANDER DIST.: Gander, *Rouleau* 6133 (CAN, NFLD, US). GRAND FALL DIST.: Overflow Pond, *Rouleau* 7961 (NFLD). HUMBER DIST.: Corner Brook, *Rouleau* 3960 (ACAD, CAN, GH, NFLD, NY, US). ST. BARBE DIST.: Bonne Bay, *Bishop* 471 (GH, CAN). ST. JOHN'S DIST.: St. John's, *Robinson & Schrenck* 41 (GH, CAN, MIN, MO, NY, P). TRINITY SOUTH DIST.: Whitbourne, *Rouleau* 6069 (NFLD). TWILLINGATE DIST.: Loon Bay, *Rouleau* 4866 (NFLD). WHITE BAY DIST.: St. Anthony, *Savile & Vaillancourt* 2561 (NCU, NFLD, NY). **Nova Scotia:** ANNAPOLIS CO.: Belleisle, *Bent* 12723 (ACAD). ANTIGONISH CO.: Linwood, *Smith, et. al.* 10765

(MAINE). CAPE BRETON CO.: Frenchvale, *Smith, et. al.* 15094 (ACAD). COLCHESTER CO.: Truro, *Malte,* (CAN, QUK). CUMBERLAND CO.: Wharton, *Schofield* 3197 (ACAD). DIGBY CO.: Corberrie, *Jack* 3121 (MAINE, NY, US). GUYSBOROUGH CO.: Canso, *Rousseau* 35450 (CAN). HALIFAX CO.: Halifax, *Jack* 3235 (NY, TENN). HANTS CO.: Bishopville Rd., *Wellwood* 12662 (ACAD). INVERNESS CO.: North Mt., *Smith, et. al.* 11275 (ACAD). KING CO.: Wolfville, *Anderson* (ACAD). LUNENBURG CO.: Beck Lake, *Smith, et. al.* 18551 (ACAD, NCU). PICTOU CO.: Westville, *Sampson* 28 (ACAD). QUEENS CO.: Tobeatic Lake, *Martin* 5210 (CAN). RICHMOND CO.: Grand Lake, *Ershine* 51993 (QUK). SHELBURN CO.: Barrington Passage, *Macoun* 81371 (CAN). VICTORIA CO.: Cape Breton, *Senn* 1553 (MIN, US). YARMOUTH CO.: Seal Isl., *Erskine* 54.977 (ACAD). **Ontario:** BRUCE CO.: Big Bay, *Krotkov* 9295 (NY). CARLETON CO.: Wright's Cove, *Minshall* 236 (MIN, NY). COCHRANE CO.: Abitibi, *Pritchard* 208A (MASS). DUNDAS CO.: Elma, *House* 23357 (PENN). FRONTENAC CO.: Kingston, *Fowler* (US). HALIBURTON CO.: Minden Twp., *Roberts* (TRT). KENORA DIST.: Attawapiskat River, *Porsild, et. al.* 19986 (CAN). LENNOX CO.: Skootamatta, *Jackson* (TRT). MANITOULIN DIST.: Honora, *Soper & Bell* 9819 (CAN, QUK, TRT). MUSKOKA DIST.: Sparrow Lake, *Walden* 110 (TRT). NIPISSING DIST.: Stuarts, *Ross* 2 (TRT). ONTARIO CO.: Cannington, *Thompson* 516 (TRT). PARRY SOUND DIST.: Ahmic Lake, *Soper* 5225 (CAN, TRT). PRESCOTT CO.: Alfred Twp., *Calder & Cody* 922 (PENN). RENFREW CO.: Renfrew, *Stroud* (TRT). STORMONT CO.: Newington, *Jenkins* 8297 (NCU). SUDBURY DIST.: Sudbury, *Ostenfeld* 613 (CAN). THUNDER BAY DIST.: Longlac, *Baldwin & Breitung* 3693 (CAN, TRT). TIMISKAMING DIST.: Cattle Isl., *Moss* 77 (ALTA). WELLAND CO.: Niagara, *Zenkert* (OAC). **Prince Edward Island:** KING CO.: Dundee, *Fernald, Long, & St. John* 7899 (GH). QUEENS CO.: Brackley Beach, *Grandtner* 13518 (CAN). **Quebec:** ABITIBI CO.: Amos, *Morton* 11035 (US). ARGENTEUIL CO.: Lachutem, *Porsild* 6337 (CAN). BERTHIER CO.: Lanoraie, *Scoggan* 370 (CAN). BONAVENTURE CO.: New Richmond, *Chrysler* 1228 (CHRB). BROME CO.: Bolton, *Knowlton* (GH). CHICOUTIMI CO.: Lac Kenogami, *Lavoie, Doyon, & Lord* 600706-01 (ACAD, TRT). GASPE WEST CO.: Mt. Albert, *Cottam* 11852 (UT). GATINEAU CO.: Wilson Corners, *Mitchell* 1750 (TENN). KAMOURASKA CO.: Ouelle, *Gauthier* 65-207 (QUK). LABELLE CO.: Nomininque, *Roy* 1053 (ACAD). LEVIS CO.: Chaudiere, *Forbes* (CAN). MAGDALEN ISLAND CO.: Amherst Isl., *Potter & Brierly* 3425 (NMC, UT). MASKINONGE CO.: Metis Beach, *DuBoulay & DuBoulay* 2589 (QUK). MATANE CO.: Lake Montagne, *Boivin* 786 (PENN). MATAPEDIA CO.: Saint Zenon, *Blain* 321 (CAN). MEGANTIC CO.: Black Lake, *Blais, Deshaies, & Forest* 10379 (CAN, QUK, SASK). MISSISQUOI CO.: Farnham, *Maycock* 1863 (QUK). MONTCALM CO.: Lac Tapani, *Pennell* 16678 (NY). MONTMORENCY CO.: Boischatel, *Cauchon, et. al.* 69-111 (MU, TRT). PORTNEUF CO.: *Marie-Victorin* 9437 (WS). RICHELIEU CO.: Saint-ours, *Rolland-Germain* 43513 (GH). RIMOUSKI CO.: Cap Enrage, *Rousseau* 26877 (GH). RIVIERE DU LOUP CO.: *Soper* 3670 (TRT). SAGUENAY CO.: Mingan, *Townsend* (GH); Natashquan, *Abbe* 1188 (GH); Romaine, *St. John* 90652 (GH); Round Lake, *Gillett* 5208 (GH); Seven Isl., *Harper* 3309 (CAN, HNH, PENN, US), *Robinson* 769 (CAN, GH, NY). SHERBROOKE CO.: Orford, *Martineau* 35 (CAN). TEMISCOUATA CO.: Trois Pistoles, *Fox* (TRT). TERREBONNE CO.: St. Sophe, *Wahl* 19419 (PAC). TIMISKAMING CO.: Ottawa River, *Baldwin* 5823 (CAN, SASK). TWO MOUNTAINS CO.: La Trappe, *Louis-Marie* 10 (GH). WOLFE CO.: Lake Nicolet, *Brisson & Hamel* 11295 (ACAD, OAC, SASK, TRT).

The synonomy of this taxon is fairly extensive. Numerous varietal and forma names have been proposed for the variation that exists, and some of these names have been elevated to specific rank. Many of these lack descriptions or are listed as synonyms under a variety or form name. Except for these subspecific categories only a few other names have been applied to this taxon. One of these was when Kuntze (1891) transferred the specific epithet *angustifolia* to another genus while the others were proposed by Rafinesque (1840).

Most of the subspecific categories that have been proposed for *Kalmia angustifolia* var. *angustifolia* are for variation and extremes in flower color (*carnea, rosea, rubra*), variation in size and habit of the plant (*media, minima, nana, procumbens, pumila*) and variation in shape and color of the leaves (*lucida, oleifolia, ovata, variegata*). In general, the differences in flower color appears to represent natural variation within populations and the above are better treated as cultivars than as forms. This is also true of the variation in leaf shape and color, and, in part, for variation in plant height. Holmes (1956) discusses some of these cultivars.

The dwarf condition reported for *Kalmia angustifolia* var. *angustifolia* is either the result of selection of more northern or high altitude sources or because of inbreeding depression. Jaynes (1968a) found that seedlings from selfed plants average about half the height of seedlings from outcrossed plants. He also found that seed set from self-pollinated plants is 85-90% less than that from cross pollination and that there is a marked reduction in survival of the seedlings from selfed plants. This indicates that this species is only weakly self compatible and that outcrossing usually occurs under natural conditions.

Kalmia angustifolia var. *angustifolia* commonly occurs in bogs, swamps, and other wet places, usually forming dense thickets around ponds and lakes. It is also found in open woods, as a weed in fields, and in moist openings of pine savannas. It is distributed from the northeastern part of the Michigan peninsula and the eastern half of Ontario, east through Quebec, the Maritime Provinces, and Newfoundland; north to at least the Attawapiskat River (Kenora District) in Ontario and to Goose Bay and Cartwright in Labrador; and south in eastern United States through New England and eastern New York, eastern Pennsylvania and Maryland to the coast in New Jersey and Delaware and the southeastern tip of Virginia. One specimen (*Davis & Davis*, 4691) has been seen which is reputed to have come from Randolph Co., West Virginia, but this collection should be considered doubtful. This species has also been reported from Indiana, but according to Deam (1940) this is an error.

It is possible that extracts from sheep laurel may inhibit the growth of other plants, particularly coniferous trees, thereby maintaining open areas for extended periods of time. Peterson (1965) found that the leaves of this species contain a substance that hinders the primary root development of black spruce by destruction of the epidermal and cortical cells. He further suggests that this may be the reason for the abnormally poor growth of trees associated with *Kalmia angustifolia* on upland sites in the boreal region of eastern Canada.

Studies by Jaynes (personal communication) reveal that some incompatibility exists between the two varieties of *Kalmia angustifolia*. This incompatibility is highly variable, depending upon the parents used, with the resulting offspring varying from completely sterile to highly fertile. Many of these hybrids produced a large quantity of viable seed while in others the capsules remained small and lacked seeds. From some crosses, both sterile and fertile individuals were produced. Also, among the offspring that produced no seeds, stainable pollen varied from 64% to 2%.

All artificially produced hybrids between these two taxa are similar to *Kalmia angustifolia* var. *angustifolia,* and except for the lack of seed set in some, could not be distinguished from it. All individuals have glandular calyces and most have leaves that are not puberulent beneath, both characteristics of typical var. *angustifolia.* Only 2 hybrids were found that had leaves which were puberulent beneath. More studies are needed to clarify the status of these taxa, but until more information is available, it seems best to maintain them as varieties.

Kalmia angustifolia L. var. **angustifolia** f. **candida** Fern. Rhodora **15:** 151. 1913.

Kalmia angustifolia var. *candida* (Fern.) Rehd. *In:* Bailey, Stand. Cycl. Hort. **3:** 1734. 1915. TYPE: **Newfoundland:** damp mossy or turfy hollows on hill south of St. John's, *Fernald & Wiegand* 6019 (GH).

According to Jaynes (1971a, 1971b) the presence of pigment in *Kalmia angustifolia* is determined by a single dominant gene, and the true-breeding recessive is white flowered. These white flowered individuals are anthocyaninless with green stems, as contrasted to the normal wild types with reddish stems. This characteristic is particularly obvious in seedlings.

It is possible that the recessive genes for the anthocyaninless condition are farily common in populations of this species, but are rarely expressed. In a population of *Kalmia angustifolia* from Madison, Connecticut, Jaynes (1971b) found that about 24% of the population was heterozygous for the anthocyaninless condition, but no homozygous recessive plants were found. It appears that the anthocyaninless plants are at a selective disadvantage in the wild.

SPECIMENS EXAMINED

UNITED STATES: **Maine:** ANDROSCOGGIN CO.: *Gordon* 407

(MAINE). LINCOLN CO.: *Hyland* 69 (MAINE). **Massachusetts:** Sherborn, *Loomis* (GH).

CANADA: **Newfoundland:** St. Johns, *Fernald & Wiegand* 6019 (GH).

4b. **Kalmia angustifolia** L. var. **caroliniana** (Small) Fern. Rhodora 39: 476, 498. 1937.

Kalmia caroliniana Small, Fl. Southeast. U.S. 1336. 1903. TYPE: **North Carolina:** Flat Rock, *L. R. Gibbs* (NY).

Kalmia carolina Small, Fl. Southeast. U. S. 886. 1903. *Kalmia angustifolia* var. *carolina* (Small) Fern. Rhodora 39: 437. 1937.

Mature leaves permanently puberulent beneath with a dense covering of whitish, simple hairs, scattered stalked glandular hairs also present; calyx strongly puberulent, lacking stalked glandular hairs; corolla usually strongly puberulent on the outside.

Distribution: Open woods and shrubby bogs in the mountains and sandy woods, pocosins, savannas and bogs on the coastal plains. Extending from extreme southern Virginia through North Carolina to eastern South Carolina and west to eastern Tennessee and northeastern Georgia.

Common name: Sheep Laurel, Lambkill.

REPRESENTATIVE SPECIMENS

Georgia: RABUN CO.: Oakey Mt., *Duncan* 3281 (GH, ID, ISC, MO, NY, TENN, US), 4312 (ISC); Tom's Swamp, *Bookout & McDowell* 65 (GH). **North Carolina:** ALLEGHANY CO.: Edmonds, *Radford* 38191 (NCU). AVERY CO.: Pineola Bog, *Cain & Duncan* 251-3 (IND, ND). BEAUFORT CO.: Chocowinity, *Radford* 33396 (NCU). BLADEN CO.: White Lake, *Kral* 27210 (VDB). BUNCOMBE CO.: Asheville, *McGarthy* (US). CARTERET CO.: Beaufort, *Bentley* (VDB). CHOWAN CO.: Tyner, *Ahles* 39907 (NCU). COLUMBUS CO.: Chadbourn, *Wilbur* 5315 (DUKE). CRAVEN CO.: New Bern, *Harbison* 14080 (NCU), 14932 (NCU). CUMBERLAND CO.: Stedman, *Wilbur* 5169 (DUKE). DARE CO.: Manns Harbor, *Radford* 8197 (NCU). DUPLIN CO.: Charity, *Fogg, Jr.* 5481 (GH, PENN). GATES CO.: Gatesville, *Godfrey* 5214 (DUKE, GH). GREENE CO.: Walstonburg, *Radford* 36508 (NCU). HARNETT CO.: *Blomquist* 4486 (DUKE). HENDERSON CO.: Muddy Creek, *Smith* 221 (ISC, US). HOKE CO.: Timberland, *Ahles* 29514 (IND). HYDE CO.: *Radford & Stewart* 803 (NCU). JACKSON CO.: Cullowhee, *Biltmore*

Herb. 1344e (ALTA, GH, US). JOHNSTON CO.: Benson, *Smith* (IND, NCU). JONES CO.: Hargetts Store, *Radford* 36956 (NCU). LENOIR CO.: Pine Hill, *Radford* 31651 (NCU). MACON CO.: Highlands, *Wilson* 1854 (TENN). MARTIN CO.: Robersonville, *Radford* 35364 (ISC). MONTGOMERY CO.: Pekin, *Radford* 14595 (NCU). NEW HANOVER CO.: Wilmington, *Newber* 165 (UARK). ONSLOW CO.: Dixon, *Moldenke* 1242 (DUKE, MIN, MO, NY, PENN, US). PASQUOTANK CO.: Elizabeth City, *Ashe* (NCU). PENDER CO.: Wards Corner, *Ahles & Bell* 7856 (MISSA, MSC). PERQUIMANS CO.: Beach Spring, *Radford* 5470 (NCU). PITT CO.: Staton, *Radford* 34940 (NCU). RICHMOND CO.: Rockingham, *Coker* (NCU). ROBESON CO.: Allenton, *Ahles & Ramseur* 23770 (ND, PAC). SAMPSON CO.: Tomahawk, *Fox & Boyce* 3792 (KY). SCOTLAND CO.: Wagram, *Correll* 1181 (DUKE). TRANSYLVANIA CO.: Cedar Mt., *Freeman* 58130 (NCU). TYRRELL CO.: Cross Landing, *Radford* 33820 (NCU). WASHINGTON CO.: Hoke, *Radford* 35264 (NCU). WATAUGA CO.: Deep Gap, *Radford* 6239 (NCU). WAYNE CO.: Goldsboro, *Radford* 22006 (NCU). **South Carolina:** DARLINGTON CO.: between Darlington & Society Hill, *Smith* 1068 (NCU). HORRY CO.: *Radford & Stewart* 979 (NCU, NY). ORANGEBURG CO.: Edisto Swamp, *Ravenel* (GH). SUMTER CO.: Poinsette St. Park, *Holdaway* (DUKE). **Tennessee:** JOHNSON CO.: Cole's Bog, *Shanks & Sharp* 1115 (PENN, TENN); Shady Valley, *Barclay* (TENN), *Sharp & Underwood* 1252 (VDB), 1552 (NCU, NY), 3161 (NY). KNOX CO.: Kingston Pike, *Jennison* 717 (TENN). **Virginia:** CARROL CO.: Woodlawn, *Massey* 5058 (GH). NANSEMOND CO.: Whaleyville, *Fernald & Long* 7564 (GH, NY, US). NORFOLK CO.: Dismal Swamp, *Coville & Kearney, Jr.* 91 (OS, US), Portsmouth Ditch, *Grimes* 4517 (MIN, NY). SOUTHAMPTON CO.: Franklin, *Fernald & Long* 10002 (GH).

The name first applied to this taxon was *Kalmia carolina* when Small (1903) separated the plants with puberulent leaves from typical *K. angustifolia.* Later in a list of genera and species in the same publication (page 1336) the name was changed to *K. caroliniana.* It is very possible that this later name is a printing error, particularly since the name *K. carolina* was used by the author in a later publication (Small, 1914). Fernald (1937) transferred the epithet *carolina* to a variety of *K. angustifolia* (page 437), but later in the same publication (page 476, 498) changed the name to variety *caroliniana,* stating that this spelling, "since it accompanied the citation of the type, should prevail."

Kalmia angustifolia var. *caroliniana* has a fairly restricted range. Most of the specimens examined are from the coastal plain and the mountains of North Carolina with the species being extremely common on the pocosins and in bogs. This taxon also has a sporadic occurrence in the coastal plain of South Carolina (Radford, Ahles, and Bell, 1968) and in southern Virginia (Fernald, 1938, 1939), while it has been reported from a few localities in the mountains of extreme eastern Tennessee by Jennison (1935) and Shanks (1952) and from two mountain bogs in the Blue Ridge of northeastern Georgia by Duncan (1948).

The characteristics used to separate *Kalmia angustifolia* var. *caroliniana* are very reliable, but occasionally some overlap does occur. Usually, var. *angustifolia* has glandular calyces and leaves that are not puberulent beneath while in var. *caroliniana* the calyces are eglandular and the leaves are strongly puberulent beneath. All but two specimens of var. *caroliniana* examined had strongly puberulent leaves and even those were lightly puberulent on the undersurface of the leaf. This was also noticed by Radford, Ahles, and Bell (1968) who mentioned that a few specimens of var. *caroliniana* with glabrate leaves were found in the Carolinas. A few specimens of var. *angustifolia* from Nantucket Island and the coast of Massachusetts and Connecticut have leaves that are strongly puberulent beneath. All of these, however, have strongly glandular calyces, typical of var. *angustifolia*, and are referred to that taxon. The best character to separate the two varieties is the presence or absence of stalked glandular hairs on the calyx. Close examination, however, reveals that on some specimens of var. *caroliniana* a few glandular hairs are present on the calyces. The glands are not very numerous, however, and mostly restricted to the margins of the lobes or to the base of the calyx. Even on the holotype a few of these stalked glandular hairs are found. Because of this variability it is probably best to maintain these taxa as varieties of one species rather than as separate species.

A white flowered, anthocyaninless form of var. *caroliniana* also exists. It is similar genetically to *Kalmia angustifolia* var. *angustifolia* f. *candida* in that it is a homozygous recessive plant in which flower color is determined by a single pair of genes (Jaynes, 1971b). A specimen of this form was obtained by Dr. Jaynes from the Garden-in-the-Woods, in Sudbury, Massachusetts. No wild individuals have been found and its origin is not known. The best crossing results obtained by Jaynes (1968a) between *K. angustifolia* and other species of the genus were when this white flowered form was used as the female parent (Jaynes, 1971b).

5. **Kalmia cuneata** Michaux, Fl. Bor.-Amer. **1**: 257. 1803. *Chamaedaphne cuneata* (Michx.) Kuntze, Rev. Gen. Pl. **2**: 388. 1891. TYPE: In Carolina, *Michaux s.n.*, (GY).

Much branched rhizomatous shrub to 1.5 m tall; branchlets terete, reddish brown, usually adscending, stipitate-glandular and puberulent, becoming glabrous and light gray; leaves alternate, deciduous, flat, oblanceolate to elliptic-lanceolate, 2-6 cm long, 0.5-1.5 cm wide, lightly stipitate glandular beneath, glabrous above, apex obtuse to acute, apiculate, base narrowly cuneate, midrib puberulent above, stipitate-glandular beneath; petiole to 4 mm long; inflorescence a reduced corymbiform raceme or fascicle of 3-10 flowers in the upper axils of the last season's growth, pedicels 1-3 mm long, glabrous to lightly stipitate-glandular, recurved in fruit, subtended by 2 bracteoles in the axil of a small lanceolate bract about 1 mm long, main axis of the inflorescence less than 3 mm long; calyx glabrous to lightly stipitate-glandular, 6-7.5 mm broad, the lobes oblong, apex acute; corolla creamy white with a red band within, lightly stipitate-glandular outside, puberulent near the base within, 1.3-1.8 mm broad; anthers purplish brown, 1-1.3 mm long; filaments puberulent toward the base; style 7-10 mm long; ovary stipitate-glandular; capsule depressed globose, 4-6 mm broad, 2.5-3.5 mm long, stipitate-glandular; seeds light brown, 0.6-0.9 mm long, the testa not loose or extended past the ends of the seed. Chromosome number $n = 12$.

Distribution: Wet thickets and shrub bogs in southeastern

North Carolina and adjacent South Carolina.

Common name: White Wicky.

REPRESENTATIVE SPECIMENS

North Carolina: BLADEN CO.: Colly Creek, *Ashe* (PH); 10 miles north of Elizabethtown, *Ebinger* 11271 (EIU); Jerome Pocosin, *Buell & West* 1740 (MIN). CUMBERLAND CO.: Hope Mill, *Alexander* (NY). MOORE CO.: Pinehurst, *Wicker* (NY). PENDER CO.: Squalling Bluff Rd., *Coville* (MICH, NY, US); Burgaw, *Chrysler* 2262 (CHRB). RICHMOND CO.: Hamlet, *Wiegand & Manning* 2365 (GH). **South Carolina:** DARLINGTON CO.: Hartsville, *Smith* (NY), *Coker* (NY).

A small fragment of the type of *Kalmia cuneata* is at the Gray Herbarium. It consists of one fascicle of 5 flowers and a small stem with a few leaves attached. On the label is written "Ex Herb. Michaux *Kalmia cuneata*." At the present time the rest of the type has not been located.

Kalmia cuneata is very distinct. The only species that it could possibly be confused with is *K. angustifolia* since their general habit and leaf size are similar. *Kalmia cuneata*, however, is the only deciduous member of the genus and the only one in which the flowers are borne in fascicles from the axils of last season's growth. Other distinguishing characteristics are the creamy-white flowers with a red band within, the oblanceolate leaves, and the recurved fruiting pedicels.

Genetically, this species appears to be most closely related to *Kalmia hirsuta*, another alternate leaved species of the southeastern United States. Jaynes (1968a) reported that *K. cuneata* set no seed when used as the female parent, but as the male parent crossed with both *K. angustifolia* and *K. hirsuta*. The cross with *K. angustifolia* produced only inviable hybrids. Most of the hybrids with *K. hirsuta* were also inviable, producing sectors of albino or yellow-green tissue, but one hybrid flowered and was pollen sterile.

This species is one of the rarest shrubs in North America and few early reports exist concerning its distribution. Pursh (1814) reports that it occurs on the mountains of Carolina, while Nuttall collected it between Camden, South Carolina and Statesville, North Carolina (Wood, 1961).

Curtis (1835) reported its occurrence about 30 miles NE of Wilmington, North Carolina. Present studies indicate that it grows only in the sandhills and bay margins of the pocosin ecotones of the Carolinas. It now is known from 8 counties in this region (Radford, Ahles & Bell, 1968).

6. **Kalmia hirsuta** Walt. Fl. Carol. 138. 1788.

Chamaedaphne hirsuta (Walt.) Kuntze, Rev. Gen. Pl. 2: 388. 1891. *Kalmiella hirsuta* (Walt.) Small, Fl. Southeast. U. S. 886. 1903. TYPE: unknown.

Kalmia ciliata Bartram, Trav. N. & S. Carol. v, 7, 94, 171, 242, 1791. (nom. nud.).

Low, sparingly branched shrub, to 6 dm tall with a thick basal caudex; branchlets terete, reddish brown, puberulent and densely hispid; leaves alternate, sessile or with a petiole to 1 mm long, elliptic to ovate, 5-14 mm long, 1.5-8 mm broad, the margins usually slightly revolute, usually puberulent and hispid on both surfaces, small stipitate glands usually present beneath, apex acute, base broadly cuneate to rounded; flowers solitary (rarely in fascicles of 2-5 or in compact racemes) in the axils of the leaves of new growth; pedicels to 1.5 cm long, stipitate-glandular and hispid, subtended by a pair of bracts; calyx green, the lobes foliaceous, lanceolate, 3-8 mm long, hispid, tardily deciduous in fruit; corolla pink (rarely white), marked with red around the anther pockets and a red ring near the base, 1-1.5 cm broad, usually lightly hirsute and stipitate-glandular on the keels outside, puberulent at the base within; anthers purplish brown, 0.7-1.3 mm long; filaments puberulent toward the base; ovary usually stipitate glandular; style 5-7 mm long; fruit 2-4 mm broad, 2-3.5 mm long, subglobose to ovoid, thinly stipitate-glandular; seeds light brown, 0.3-0.5 mm long, the testa not loose or extended past the ends of the seed. Chromosome number $n = 12$.

Distribution: Low, sandy pine savanna, sand hills, dunes and flat pine woods on the coastal plains of southern Alabama and Georgia, northern Florida and the southern tip of South Carolina.

Common name: Sandhill Laurel, Calico-bush.

REPRESENTATIVE SPECIMENS

Alabama: BALDWIN CO.: Gulf State Park, *Webster & Wilbur* 3539 (GH, NY, US). MOBILE CO.: Theodore, *Pennell* 4513 (MICH, NY, PENN, PH). **Florida:** ALACHUA CO.: Cross Creek, *Ford* 2250 (GH, TENN). BAY CO.: Lynn Haven, *Billington* (MICH, US); *Lazor* 5006 (PAC). CLAY CO.: Kingsley Lake, *Henry* 3828 (PH). COLUMBIA CO.: Lake City, *Nash* 2193 (GH, MASS, MICH, MIN, MSC, ND, NY, OS, PH, US). DIXIE CO.: Old Town, *West & Arnold* (PH). DUVAL CO.: Jacksonville, *Curtis* 4359 (ARIZ, ND, NY, US), 4921 (GH, ISC, MIN, MSC, NY, US). ESCAMBIA CO.: Pensacola, *Webster & Wilbur* 3572 (GH, NY, US). FLAGLER CO.: Bunnell, *Ames* (GH). FRANKLIN CO.: Carrabelle, *Mosier* 884 (MIN, NY, PENN, US); *Moldenke* 1134 (MIN, NY, PENN, US). GADSDEN CO.: Quincy, *Sargent* (MIN). GILCHRIST CO.: Trenton, *Ward, West & Will* 2651 (GH, US). GULF CO.: Port St. Joe, *Ward & Ward* 1460 (GH). HAMILTON CO.: *Bowers & Wofford* 71-550 (TENN). HOLMES CO.: Bonifay, *Blanton* 6582 (US). JACKSON CO.: Compass Lake, *Knight & Arnold* (PAC). JEFFERSON CO.: Wacissa, *Godfrey* 53552 (GH). LAFAYETTE CO.: *Smith & Myint* 189 (GH). LEON CO.: Silver Lake, *Godfrey* 53660 (GH, MISSA, NY). LEVY CO.: Bronson, *Godfrey & Lindsey* 56989 (GH). LIBERTY CO.: Bristol, *Small, Small & DeWinkeler* 11448 (GH, NY, PENN, TENN). MADISON CO.: Greenville, *Ramsey* 106 (MSC). MARION CO.: Ocala, *Beardslee, Jr.* (MU). OKALOOSA CO.: Crestview, *McArthur* (GH). PUTNAM CO.: Interlachen, *Fox* 5703 (GH, MICH, MIN, NY, TENN). ST. JOHNS CO.: Anastasia Island, *Crawford* (NY, PH). ST. LUCIE CO.: Fort Walton, *Henry* 1087 (PH). SANTA ROSA CO.: Munson, *Ford & Arnold* 4190 (US). WAKULLA CO.: St. Marks Wildlife Refuge, *Godfrey* 57860 (GH). WALTON CO.: Santa Rosa, *Ripley & Barneby* 10128 (NY). **Georgia:** APPLING CO.: Baxley, *Cottam* 11060 (UT); *Ebinger* 11204 (EIU). BRANTLEY CO.: Waynesville, *Ebinger* 11232 (EIU). BULLOCH CO.: Portal, *Henry* 7311 (PH). CAMDEN CO.: Waverly, *Ebinger* 11228 (EIU). CANDLER CO.: Metter, *Henry* 7277 (PH); *Hermann* 10122 (GH, US). CHARLTON CO.: Folkston, *Harbison* 5816 (GH). COFFEE CO.: *Harper* 687 (GH, US). EFFINGHAM CO.: Harper 961 (GH). GLYNN CO.: Emanuel Church Rd., *Ebinger* 11231 (EIU). JEFF DAVIS CO.: Hazlehurst, *Ebinger* 11195 (EIU). LANIER CO.: *Adams* 50 (KY). LIBERTY CO.: Altamaha River, *Small* (GH, MIN, NY, PH). LOWNDES CO.: Valdosta, *Beardslee, Jr.* (MU). MCINTOSH CO.: Darien, *Cronquist* 5366 (GH, MICH, NY, PH). TATTNALL CO.: Reidsville, *Cronquist* 5340 (GH, IND, MICH, NY, PH, US). THOMAS CO.: Thomasville, *Taylor* (GH, MIN): TIFT CO.: Tifton, *Hardin & Duncan* 13649 (US). WARE

CO.: Suwannee Lake, *Harper* 48 (PH), 298 (GH, NY, PH, US). WAYNE CO:. Grangerville, *Ebinger* 11233 (EIU). WORTH CO.: Poulan, *Pollard & Maxon* 563 (NY, US). **South Carolina:** BEAUFORT CO.: Ferry Landing, *Bell* 3805 (NY). HAMPTON CO.: Hampton, *Leonard & Radford* 1662 (ARIZ, BRY, CHRB, NHA). JASPER CO.: Ridgeland, *Ebinger* 11242 (EIU).

Except for transfers of the specific epithet, *hirsuta*, to other genera, only one other name has been proposed for this taxon. Bartram (1791) used *Kalmia ciliata* for a plant he observed on his travels through the southeastern United States. He used this name a number of times but did not include a description (Merrill, 1945). He did, however, describe "a diminutive but elegant *Kalmia*" (page 18) which undoubtedly refers to *K. ciliata*. This description leaves no doubt that his *K. ciliata* is the same as *K. hirsuta*. The first time the name *K. ciliata* appears with a description is in the work of Dumont de Courset (1811) who attributes the name to Bartram.

Kalmia hirsuta has a relatively limited distribution, occurring along the coastal plain in southeastern United States. Small (1903, 1914) indicated that it extended from Virginia to Florida, perpetuating an error started by Gray (1856). Its occurrence in Virginia is extremely doubtful (Fernald, 1947) and is probably due to a few herbarium specimens with incomplete or erroneous collecting data. Two such specimens have been found during the present study. Both were collected during the middle of the last century and beside the collector's name and the year collected include the name Virginia.

Most of the specimens of *Kalmia hirsuta* examined are hispid on the stems, leaves, and pedicels. A few specimens were found, however, that were completely glabrous, lacking the long coarse hairs as well as the stipitate-glands and smaller hairs commonly found on most parts of the plant. Variation also occurs in the arrangement of the flowers on the plant. Usually the flowers are solitary in the axils of the leaves, but occasionally the flowers occur in fascicles of 2-5, while a few specimens were found in which short racemes occur in the axils of the leaves. In other specimens the flowers appeared as a terminal raceme due to a shortening of the internodes and a reduction in the size of the subtending leaves. The pedicels also vary extensively in length. The flowers of some plants are nearly sessile, while in others the pedicels are 1.5 cm long with the two basal bracts scattered along the stalk.

Genetically *Kalmia hirsuta* appears to be closely related to *K. latifolia* with which it can be crossed to produce viable hybrids with 0-10% pollen stainability. Jaynes (1968a) also reported that it can be crossed with both *K. angustifolia* and *K. cuneata* producing viable but sterile hybrids. Based on habit and morphology *K. hirsuta* is most closely related to *K. ericoides*. These species were placed in the genus *Kalmiella* by Small (1914) since they have a deciduous calyx and their flowers are borne singly in the axils of the leaves. Unfortunately the Cuban member of the genus is not available for genetic studies.

7. **Kalmia ericoides** Wright ex Griseb. Cat. Pl. Cubensium 51. 1866.

Chamaedaphne ericoides (Wright ex Griseb.) Kuntze, Rev. Gen. Pl. 2: 388. 1891. *Kalmiella ericoides* (Wright ex Griseb.) Small, North Amer. Fl. 29: 54. 1914. TYPE: Cuba occ. in distr. Guane, in pinetis arenosis pr. La Grifa, *C. Wright* 2199 (GH, NY, US - Isotypes).

A sparingly branched, erect to spreading shrub, to 10 dm tall with a thick basal caudex; branchlets light gray to reddish-gray, puberulent and commonly densely hispid and stipitate-glandular (rarely glabrous); leaves alternate, persistant, thick, leathery, subsessile or with a puberulent petiole to 1 mm long, linear, 4-13 mm long, 0.6-2 mm broad, the margins strongly revolute, usually lightly hispid and stipitate-glandular on both surfaces, sometimes strongly puberulent (rarely glabrous); flowers solitary (rarely in fascicles or in compact racemes) in the axils of the leaves at the end of the branches, forming a terminal cluster; pedicels to 13 mm long, commonly hispid and stipitate-glandular, subtended by a pair of puberulent bracts 1-3 mm long; calyx green, the lobes foliaceous, lanceolate, 3-6 mm long, usually hispid and stipitate-glandular, tardily deciduous in fruit; corolla light pink to white, 10-17 mm broad, usually lightly hirsute and stipitate-glandular on the keels outside, lightly puberulent at the base within; anthers purplish brown, 0.8-1.2 mm long; filaments puberulent toward the base; ovary usually stipitate-glandular; style 4-7 mm long; fruit 2-4 mm broad, 2-3 mm long, subglobose to ovoid, lightly stipitate-glandular; seeds reddish-brown, 0.4-0.7 mm long, the testa not loose or extending past the ends of the seed.

Kalmia ericoides is the only member of the genus that has not been studied cytologically. Morphologically, however, it is most closely related to *K. hirsuta,* a species restricted to southeastern United States. Both have relatively small leaves (less than 1.5 cm long), that are usually hispid, their flowers are borne singly in the axils of the leaves, and the calyx is tardily deciduous. The two are easily separated, however, since the leaves of *K. ericoides* are thick and leathery with revolute margins while in *K. hirsuta* the leaves are thin and lack a strong revolute margin. Also, the flowers are borne scattered along the stem in the axils of the leaves in *K. hirsuta* while in *K. ericoides,* they are solitary in the leaf axils, but clustered toward the ends of the stems giving the appearance of a terminal corymbiform raceme.

Kalmia ericoides is endemic to savannas and pine barrens of western Cuba. Although it has a very limited distribution, the variation that exists in pubescence and compactness of the inflorescence has resulted in a division of this complex into three species by Alain (1957), while others considered it a single highly variable species (Wood, 1961). Present studies indicate that the compactness of the inflorescence is not completely reliable in separating the taxa. The variation in leaf pubescence, however, is relatively stable. As a result, the following two varieties are recognized.

KEY TO VARIETIES

1. Leaves glabrous or lightly hispid and with a few scattered stalked glandular hairs on the upper surface. .... 7a. var. *ericoides*.
1. Leaves densely puberulent and stipitate-glandular on the upper surface. .... 7b. var. *aggregata*.

7a. **Kalmia ericoides** Wright ex. Griseb. var. **ericoides.**
Kalmiella simulata Britt. & Wils. Mem. Torrey Bot. Club **16:** 93. 1920. TYPE: **Cuba:** vicinity of Los Indios, Isle of Pines, *Britton, Britton, & Wilson* 14205 (NY).

Shrub with ascending, hispid, stipitate-glandular and sometimes puberulent branchlets; leaves scattered, usually only 5-12 per cm of branchlet, glabrous to lightly hispid and stipitate-glandular above, not puberulent, 4-9 mm long, 0.6-1.5 mm wide; pedicels usually longer than the subtending leaves, giving the inflorescence an open appearance; calyx lobes 3-4.5 mm long, hispid and lightly puberulent on the outside, usually glabrous within.

Distribution: Low, white-sand savanna and pine barrens on the Isle of Pines and in the Province of Pinar del Rio, Cuba.

REPRESENTATIVE SPECIMENS

Cuba: PINAR DEL RIO: La Grifa, *Ekman* 18165 (NY, US), *Wright* 2199 (GH, NY, US); Laguna de Alcatraz Grande, *León & Victorin* 18706 (GH, US), 20474 (GH, US); El Sabalo, *Alain* 1326 (GH, US). ISLE OF PINES: Los Indios, *Britton Britton, & Wilson* 14205 (GH, NY), *Killip* 42882 (GH, NY, US), *León & Victorin* 17853 (GH), *Victorin & Alain* 77a (US).

Kalmia ericoides var. *ericoides* has a very restricted range and few herbarium specimens are available. It appears to be a fairly stable variety that varies mostly in the extent of leaf pubescence. All of the specimens seen from the province of Pinar del Rio are typical of the type specimen which has a few scattered glandular hairs and is lightly hispid on the upper leaf surface. In contrast, most of the specimens of this variety from the Isle of Pines are glabrous on the upper leaf surface. These glabrous specimens were separated as *Kalmiella simulata* by Britton and Wilson (Britton, 1920). These glabrous specimens all have small, narrow leaves (less than 9 mm long and 0.6-1.2 mm wide), pedicels that are much longer than the subtending leaves, and calyx lobes that are fairly short (less than 4.5 mm long) all characteristics of variety *ericoides*.

7b. **Kalmia ericoides** var. **aggregata** (Small) Ebinger, *comb. nov.*

Kalmiella aggregata Small, North Amer. Fl. **29:** 54. 1914. *Kalmia aggregata* (Small) Copeland, Amer. Midl. Nat. **30:** 571. 1943. TYPE: **Cuba:** pinelands, Los Indios, Isle of Pines, *Jennings* 324 (NY).

Shrub with adscending, lightly hispid and strongly puberulent branchlets; leaves crowded, usually 15-25 per cm of branchlet, densely puberulent and stipitate-glandular above, 8-13 mm long, 1-2 mm wide; pedicels usually as short as the subtending leaves, giving the inflorescence a compact appearance; calyx lobes 3.5-5.5 mm long, hispid and densely puberulent on the outside, densely puberulent within.

Distribution: Low, white-sand savanna and pine barrens on the Isle of Pines, Cuba.

REPRESENTATIVE SPECIMENS

Cuba: ISLE OF PINES: Beach at Siquanea, *Morton* 10098 (US); between Mina de Oro and Playa del Soldado, *Killip* 43905 (US), 45385 (GH); Lama Daquille, *Ekman* 72492 (NY); Los Indios, *Jennings* 324 (GH, NY, US), *León & Victorin* 18857 (GH, US), *Victorin & Alain* 77 (GH, NY, US), Playa Roja, *Killip* 43001 (GH, NY, US); San Pedro, *Britton, Britton, & Wilson* 14146 (GH, NY, US), *Killip* 43698 (US), 45566 (US), *Morton* 10018 (US), 10053 (US); Siquanea region, *Killip* 44043 (US), 44044 (US), 44753 (US), 44755 (US).

This variety appears to be more robust than the preceding. Specimens to 13 dm have been reported, and the leaves and flowers are, in general, slightly larger than in variety *ericoides*. Besides this difference in size, all of the specimens of variety *aggregata* examined are strongly puberulent throughout. In particular the leaves are strongly puberulent on both surfaces, but this is also characteristic of the branches, pedicels and sepals.

UNCERTAIN OR EXCLUDED NAMES

Kalmia lanceolata Raf. Autikon Bot. 86. 1840. This name should probably be referred to *Kalmia polifolia* but the description could apply to other taxa. No specimen to represent this name has been found.

Kalmia serotina Hoffmgg. Verz. Pflanzenkulturen 70. 1824. Nomen nudum.

Kalmia spuria Bartr. Trav. N. & S. Carol. 303. 1791. Nomen nudum.

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